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EBASCO

REM III PROGRAM

REMEDIAL PLANNING ACTIVITIES AT SELECTED UNCONTROLLED HAZARDOUS SUBSTANCE DISPOSAL SITES

EPA CONTRACT 68-01-7250

EBASCO SERVICES INCORPORATED

6.2

EPA WORK ASSIGNMENT NUMBER: 208-9LC1
EPA CONTRACT NUMBER: 68-01-7250
CORRESPONDENCE NUMBER: RMIX/89-0011/SA
EBASCO SERVICES INCORPORATED

FINAL
GROUNDWATER CHARACTERIZATION REPORT

WASTE DISPOSAL INC.
SANTA FE SPRINGS, CA

MAY 1989

NOTICE

The information in this document has been funded by the United States Environmental Protection Agency (EPA) under REM III Contract No. 68-01-7250 to Ebasco Services Incorporated (Ebasco). This document has been formally released by Ebasco to the EPA. However, this document does not represent the EPA's position or policy and has not been formally released by the EPA.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF TABLES
(Continued)

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

Ebasco Services Incorporated (EBASCO) is conducting a Remedial Investigation/ Feasibility Study (RI/FS) for the Waste Disposal Incorporated (WDI) site in Santa Fe Springs, California. This work is being conducted in response to the U.S. Environmental Protection Agency (EPA) Work Assignment No. 208-9LC1 under Remedial Engineering Management (REM) III Contract No. 68-01-7250.

The purpose of this report is to present the results of groundwater investigations performed between September 1988 and February 1989 as part of Phase I RI activities at the WDI site. This report will discuss the methods used by Ebasco during this work, identify and discuss the physical characteristics of WDI geology and hydrogeology and define the nature and extent of groundwater contamination.

The information contained in this report will be used to identify and evaluate appropriate remedial technologies during the WDI feasibility study. For example, the success of some technologies such as bioremediation and activated carbon absorption are very dependent on knowing the type and concentration of contaminants to be treated. This report will assist in determining their applicability.

This report is the second of three media characterization reports which will be prepared for the WDI site. Together with the soil characterization report which was previously submitted under separate cover to EPA, and the subsurface gas characterization report, this report will form the basis of a Preliminary Summary Site Characterization (Phase I RI) Report. This report does not contain information on fate and transport of contaminants. This information will be contained in the Phase I RI Report.

1.2 OBJECTIVES OF REPORT

The objectives of this report are as follows:

- To identify the nature of WDI contaminants (i.e., type and concentration).

- To identify the horizontal and vertical extent of WDI contaminants.

- To provide the WDI treatability/feasibility study team with enough information to estimate the volume of contaminated groundwater which will require remediation.

- To assist the WDI health risk assessment team in the development of exposure pathways, and the development of exposure scenarios and assumptions

- To provide the EPA with a list of major data gaps and recommendations for Phase II remedial investigations necessary to reduce uncertainties about the physical and chemical characteristics of WDI's groundwater.

1.3 ORGANIZATION OF REPORT

Sections 1.0 and 2.0 of this report provide introductory and background information. Section 3.0 identifies and describes remedial investigation methodologies. Section 4.0 discusses the results of field investigations. Section 5.0 provides a summary of findings and conclusions and presents recommendations for future action.

2.0 BACKGROUND INFORMATION

2.1 SITE LOCATION

The Waste Disposal Inc. (WDI) site (latitude 37° 57.0'N, longitude 118° 03.0'W) consists of a 43-acre parcel located at T2S, R11W, S32 in the city of Santa Fe Springs, Los Angeles County, California (Figure 2-1). It is bordered on the northwest by Santa Fe Springs Road, on the northeast by a Fedco food distribution center and St. Paul's High School, on the southwest by Los Nietos Road, and on the southeast by Greenleaf Avenue (Figure 2-2).

2.2 SITE HISTORY

Waste Disposal Inc. operated as a landfill which, over a period of almost 40 years, accepted various oil field and industrial wastes (Table 2-1). Prior to 1949, operations at the facility were unregulated; between 1949 and 1965-66 Waste Disposal Inc. operated as a permitted landfill. From 1949 until closure, operations were documented sporadically. In addition, many documents have been allegedly destroyed (Herrera 1986). As a result, a comprehensive history of the site is not currently available. However, the Potentially Responsible Party Search conducted by ICF Technology (1987) and a records search and review of aerial photographs by Ebasco reveal the following information:

1. The Santa Fe Springs Oil Field was discovered by Union Oil of California in 1919. Sometime thereafter (probably between 1919 and 1928), a 1,000,000-barrel (42-million-gallon) capacity, concrete reservoir was constructed at the WDI site. It is believed that the reservoir was used for petroleum storage. In the late 1920s, the WDI reservoir was decommissioned. Aerial photographs (WCCA 1928, 1937, 1945) indicate that a similarly sized reservoir was located across Santa Fe Springs Road, approximately 800 feet to the northwest, on land owned by Union Oil.

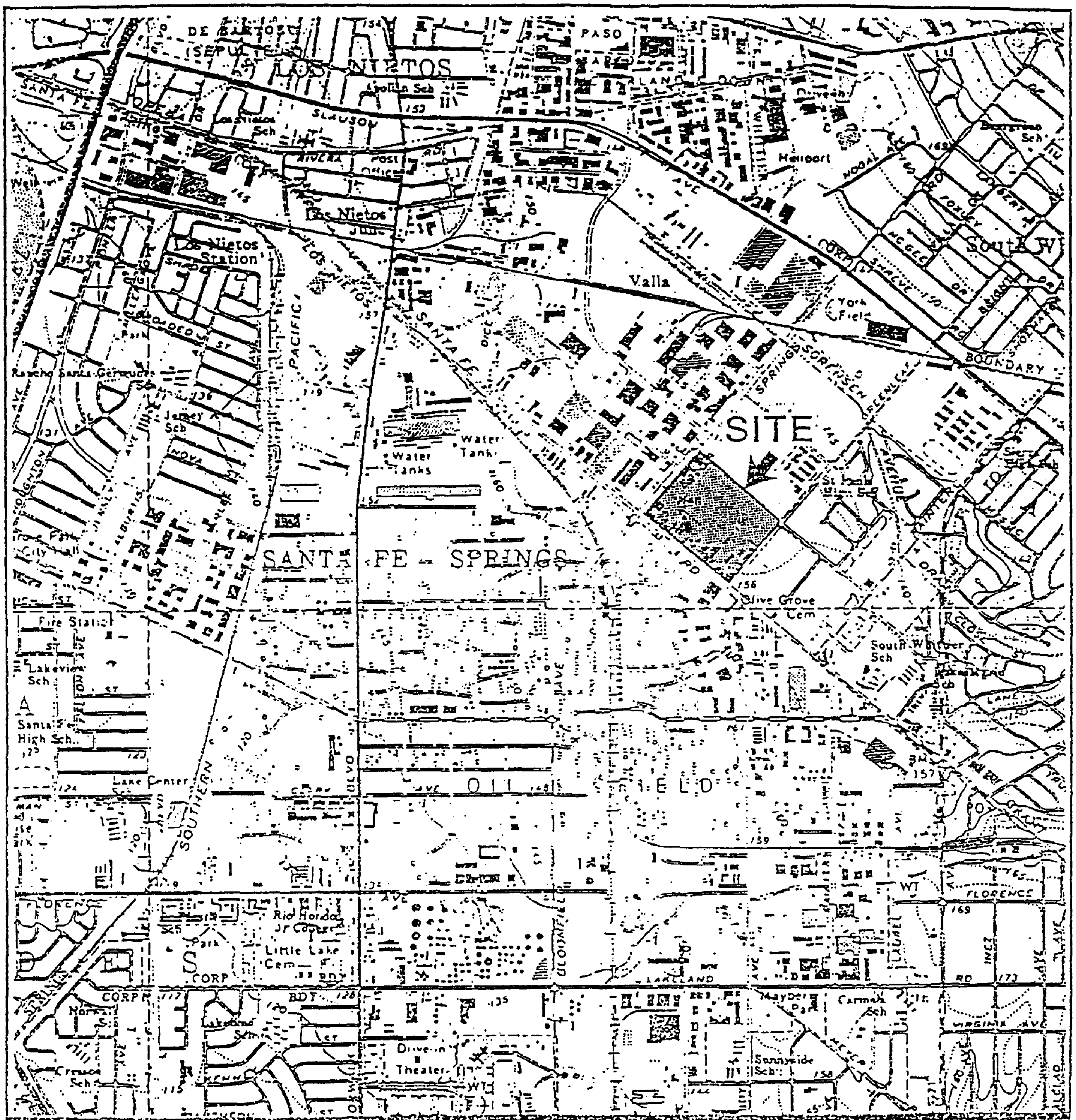
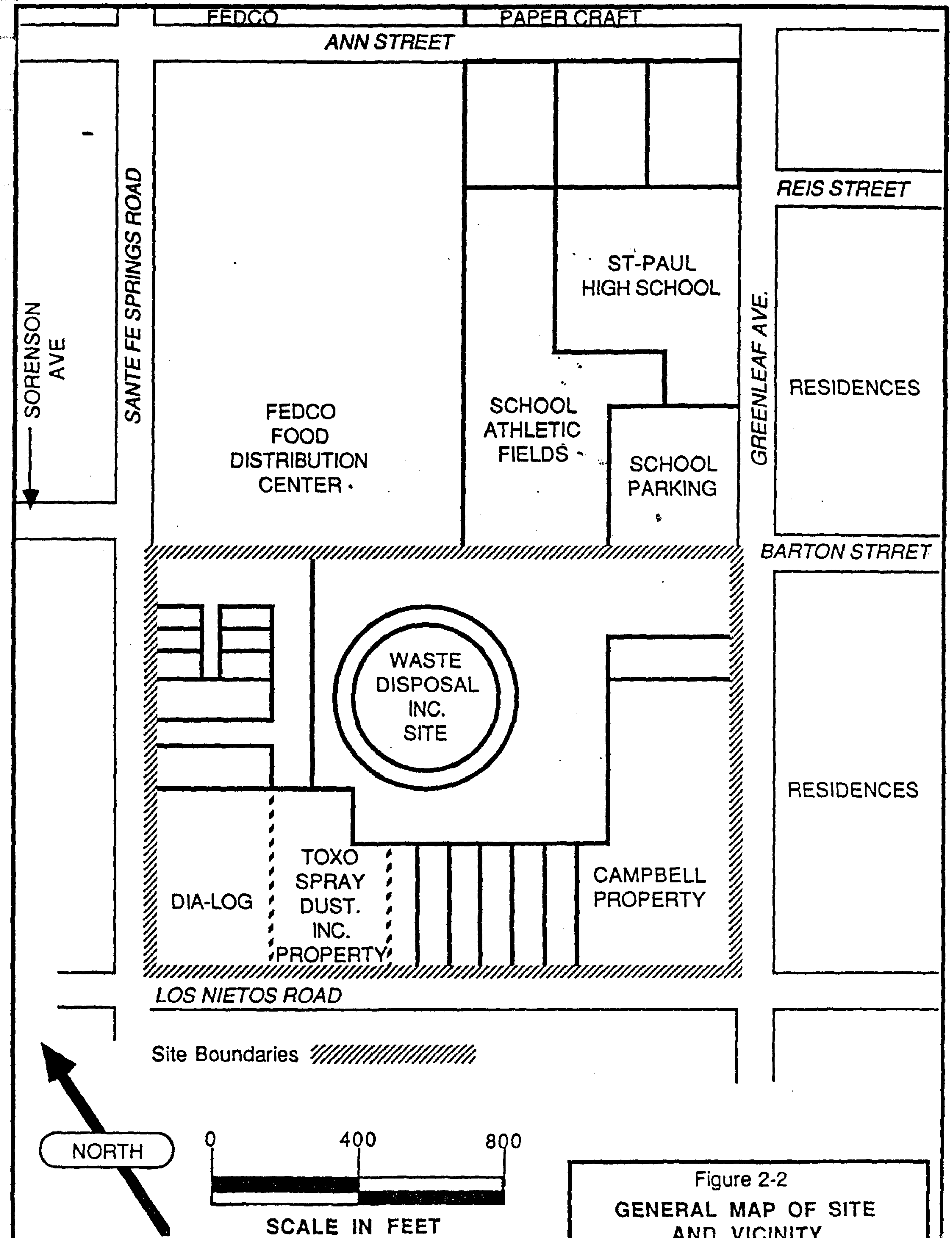


Figure 2-1

GENERAL SITE LOCATION MAP
WASTE DISPOSAL INC.

SOURCE: Adapted from USGS, Whittier, CA. 7.5' Quadrangle 1965
(photorevised 1981).



SOURCE: Adapted from Dames & Moore (1984).

Figure 2-2
GENERAL MAP OF SITE AND VICINITY WASTE DISPOSAL INC.

TABLE 2-1

HISTORICAL RECORD OF WASTE COLLECTION, TREATMENT AND DISPOSAL,
WASTE DISPOSAL INC.

Waste	Source of Waste	Quantities	Dates of Disposal	
Petroleum Refinery Tank Bottoms	Union Oil, General Petroleum, Standard Oil, Rothschild, etc.	Unknown	Unknown	Whittier Daily News (1987, 1988)
Steel Mill Slag	Unknown	Unknown	Unknown	Whittier Daily News (1987, 1988)
Brewery Wastes	Unknown	Unknown	Unknown	Whittier Daily News (1987, 1988)
Cesspool Sewage	Santa Fe Springs Waste Water Disposal Co.	Unknown	1958-?	Otteson (1958), Grancich (1958b)
Rotary Drilling Mud*	Union Oil, General Petroleum, Standard Oil, Rothschild, etc.	15,000 barrels/wk	3/8/50-?	Industrial Waste Discharge Permit 57 Carter (1953)
Clean Earth, Rock, Sand and Gravel*	Unknown	Unknown	3/8/50-?	Industrial Waste Discharge Permit 57
Paving Fragments*	Unknown	Unknown	3/8/50-?	Industrial Waste Discharge Permit 57
Concrete, Brick, Plaster*	Unknown	Unknown	3/8/50-?	Industrial Waste Discharge Permit 57
Steel Mill Slag*	Unknown	Unknown	3/8/50-?	Industrial Waste Discharge Permit 57
Dry Mud Cake*	Oil Field Sumps	Unknown	3/8/50-?	Industrial Waste Discharge Discharge Permit 57
Acetylene Sludge*	Security Engineering	200 barrels/wk	8/5/53-?	
	Chickson Co.	20 barrels/wk	8/5/53-?	Fox (1953)
Liquid Residue from Railroad Car Washing Racks and Machine Shop	Holbrook and Sons, Southern Pacific Railroad B and H Vacuum, Union Pacific Railroad, George Casey Company	Unknown	1/15/62-? 5/9/65-?	Dump Inspection Reports (Moore 1962, 1965)
Odor Control Spray	Mr. Dell, LA County, Department of Engineer	Unknown	1958-?	Grancich (1958c)
Payzone	Unknown	Unknown	11/27/53-?	LA County Engineer Photo, File I-629
Unspecified Liquid Waste	Archer-Daniels-Midland, B and B Deburring Roberts Company	Unknown	1958-? 1958/ 1959-? 1958/ 1959-?	Committee Against Waste Disposal Inc. (1958) Coates (1959), Moore (1958), Collins (1959), Medley (1959)

* Permitted Wastes.

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2. A review of aerial photographs (EMSL 1988) shows that between the late 1920s and 1949 (the date WDI was first permitted) there is evidence of the disposal of contaminated waste at the site. This evidence includes:

   - A 1937 photograph indicates that standing liquid was present outside of the reservoir to the northwest, southeast, and south of the reservoir inside dikes, and to the northwest and southwest of the reservoir outside dikes. Disturbed ground as well as areas of fill were present along Greenleaf Avenue and Los Nietos Road.

   - A 1945 photograph shows standing liquid in an excavation or pit at the corner of Greenleaf Avenue and Los Nietos Road.

3. On August 3, 1949 Fernando Caneer filed with the County of Los Angeles Regional Planning Commission a request for hearing and an application to operate a dump in the reservoir for the disposal of "solid fill, rotary mud and other non-acid oil well waste" (Tapking 1949, The Dumps 1949a, 1949b).

4. On November 15, 1949 Special Permit 634 was granted to Fernando Caneer, Marvin Pitts, Nollie B. Hudson, and Delmar Carter for the above mentioned purposes by the County of Los Angeles Board of Supervisors upon recommendation of the County of Los Angeles, Regional Planning Commission (Lee 1949).

5. On March 8, 1950 the County of Los Angeles, Department of the County Engineer, issued to Whittier Area Disposal Co. (also known as Waste Disposal Inc.) Industrial Waste Permit 57 for operation of the dump, allowing acceptance of rotary drilling mud, clean earth, rock, sand and gravel, paving fragments, concrete, brick, plaster, steel mill slag, and dry mud cake from oil field sumps.

   At the time, the one million barrel capacity reservoir, located in the center of the site, was surrounded on three sides by an earth dike, which was itself surrounded by a channel. Many unlined ponds and sumps also existed at the site.

Industrial Waste Permit 57 included provisions for rotary drilling mud and all suitable solid fill material.

6. On August 5, 1953, a request by Fernando Caneer on behalf of Waste Disposal Inc. to accept acetylene sludge for disposal was granted by the County of Los Angeles, Department of County Engineer. At the time, Waste Disposal Inc. was disposing 15,000 barrels of rotary mud per week and wished to accept 200 barrels per week of acetylene sludge from Security Engineering and 20 barrels per week of acetylene sludge from Chicksan Co.

7. On April 21, 1953 Special Permit 634 was amended to allow 24 hour per day operation of the site (Esse 1953). On March 15, 1955 Special Permit 1032 was issued by the County of Los Angeles, Regional Planning Commission, to allow Waste Disposal Inc. to annex an area 600 feet north of Los Nietos Road, and west of the reservoir for the disposal of drilling mud (O'Grady 1955, Pitts 1955, Breivogel 1955, 1956).

8. At least twice during operation of the facility the reservoir and dike system were inadequate to contain disposal liquids, sludges and mud. In 1956, liquid flowed and was pumped through "gopher holes" in the dike into a surrounding channel, and toward Greenleaf Avenue (Matthiesen 1956a). The flow of this liquid, which was estimated to be 5 gallons per minute (Matthiesen 1956b), also spilled onto adjacent property. During the winter of 1962, after heavy rain, liquids containing oily substances seeped through the northerly dike onto the nearby St. Paul's Catholic High School grounds, traveling as far as the baseball diamond (Moore 1962a, 1962b).

9. The practice of dumping oil well mud to the west of the reservoir began as early as 1950, and by 1955 "numerous deep sump holes

filled with material and oil sludge" occupied many areas outside the reservoir (Tweedy 1950, Waste Disposal Inc. 1955). However, on May 9, 1957, for the first time since the facility was permitted, Fernando Caneer was observed pumping liquid from the reservoir to an adjacent unlined sump (Otteson 1957). After this incident, the ground surface and unlined sumps surrounding the reservoir were used regularly for the disposal of liquid wastes.

According to County of Los Angeles, Department of County Engineer, Industrial Waste Division, Dump Inspection Reports, when disposal of liquids in the reservoir was discontinued, liquids were sometimes disposed of on the ground (Otteson 1958). The companies responsible for these practices were observed on at least two occasions--on July 17, 1958 when B and H Vacuum discharged liquids from Union Pacific Railroad and on May 9, 1965 when Hollbrook and Sons discharged truck washings (Grancich 1958a, Otteson 1962, Moore 1965).

Buildings adjacent to WDI's eastern edge, along Greenleaf Avenue, also discharged waste liquids onto the WDI site. Two of these companies were identified as B and B Deburring and the Roberts Company. Liquids from these sources were found by County of Los Angeles, Department of County Engineer, Industrial Waste Division inspectors, along the southern edge of the WDI site (Coates 1959, Moore 1958, Collins 1959, Medley 1959). "Ponding" of these waste liquids also occurred along the entrance road from Los Nietos Road to the WDI site (Moore 1958).

As early as July 29, 1953, the Los Angeles County sewer system received liquids from WDI: "Waste water is discharged after suitable treatment by temporary pipe line into the sanitary sewer" (Fox 1953a). Waste water appears to have been discharged into a channel leading to Greenleaf Avenue. Later, a pipe was installed to allow liquids to flow directly onto Greenleaf Avenue and into the sewer. Sometime after March 1960, a pipe from WDI was connected to the Los Angeles County sewer system with County of Los Angeles, Department of Sanitation approval (Partin 1956b, Carothers 1956, Medley and Coates 1960).

10. A 1958 photograph shows standing liquid in the reservoir, the northern corner of the containment area surrounding the reservoir and the area west of the reservoir. However, beginning in October 1958, solid fill was accepted and used to grade over the site (Grancich 1958b). By September 1961, the concrete reservoir was 50 percent full; by June 1962, it was 75 percent full; by November 1962, the reservoir was completely full of solid material and liquids flowed into diked areas (Moore 1962c, 1962d). By October 1964, the site was closed to the public; final grading of the site with topsoil continued until the end of 1966.

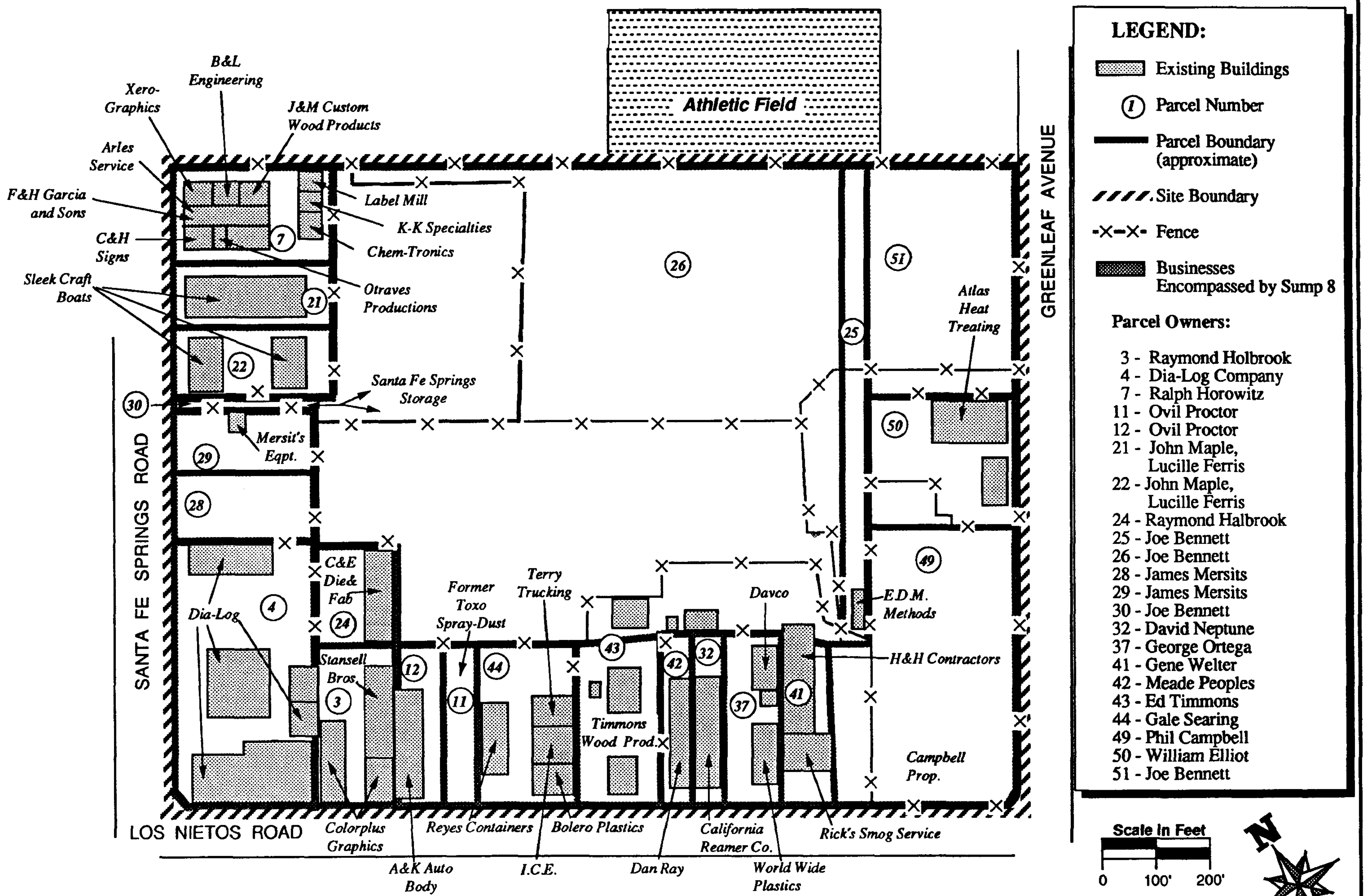
11. A 1983 photograph shows that several businesses have moved onto the site since it was closed for dumping.

2.3 LAND USE

Present land use practices on the area occupied by the WDI reservoir are limited (Figure 2-3). The majority of the area is covered with fill and a thick growth of vegetation and, other than being used for the temporary storage of equipment by area businesses, it is currently vacant. However, several area residents/workers appear to be using the site to access surrounding property.

To the north and west is the Fedco food distribution center, one large warehouse, with numerous loading docks, railroad tracks, a water tank and storage yard. Also in this general direction is located a large building which is shared by at least eight tenants including Sleek Craft Boats, F & H Garcia Plumbing, Xerographics, B&L Engineering, J&M Custom Wood Products, Label Mill, and K-K Chemtronics. The building associated with Mersit's Equipment Sales and Service is almost directly northwest of the reservoir. Located between Sleek Craft Boats and Mersit's is Santa Fe Springs Storage which contains only a narrow access road from Santa Fe Springs Road, a trailer/office, and an asphalt-covered lot used for the storage of recreational vehicles (RVs).

Figure 2-3
LAND USE MAP
WASTE DISPOSAL INC.



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To the west of Santa Fe Springs Storage and the WDI reservoir is Dia-Log, an oil well logging company. Also to the west are a number of small businesses. These businesses are located immediately to the north and east of Los Nietos Road. They include Color Graphics Plus, A&K Auto Body, Whittier Wood Products, Dan Ray, California Reamer Company, Rick's Smog Service and Auto Repair, and a sawmill. As recently as 1986, a pesticide manufacturing and storage facility--Toxo Spray Dust Inc.--was also located in this area.

To the south of the WDI reservoir is a parcel owned by Mr. Phil Campbell. Although a large portion of this property at the corner of Los Nietos Road and Greenleaf Avenue is now vacant, a group of quonset huts were located here until late 1987. These quonset huts contained numerous businesses which at various times included but were not limited to a machine shop, an ornamental nursery and an explosive manufacturing and storage facility. Today the lot is vacant with the exception of 4 quonset huts which remain along the east side of the property adjacent to Greenleaf Avenue. The southern two quonset huts are owned by Mr. Campbell and are used for general storage purposes. Atlas Steel Treating, a metals finishing business, owns the northern two quonset huts as well as the lot on which they reside.

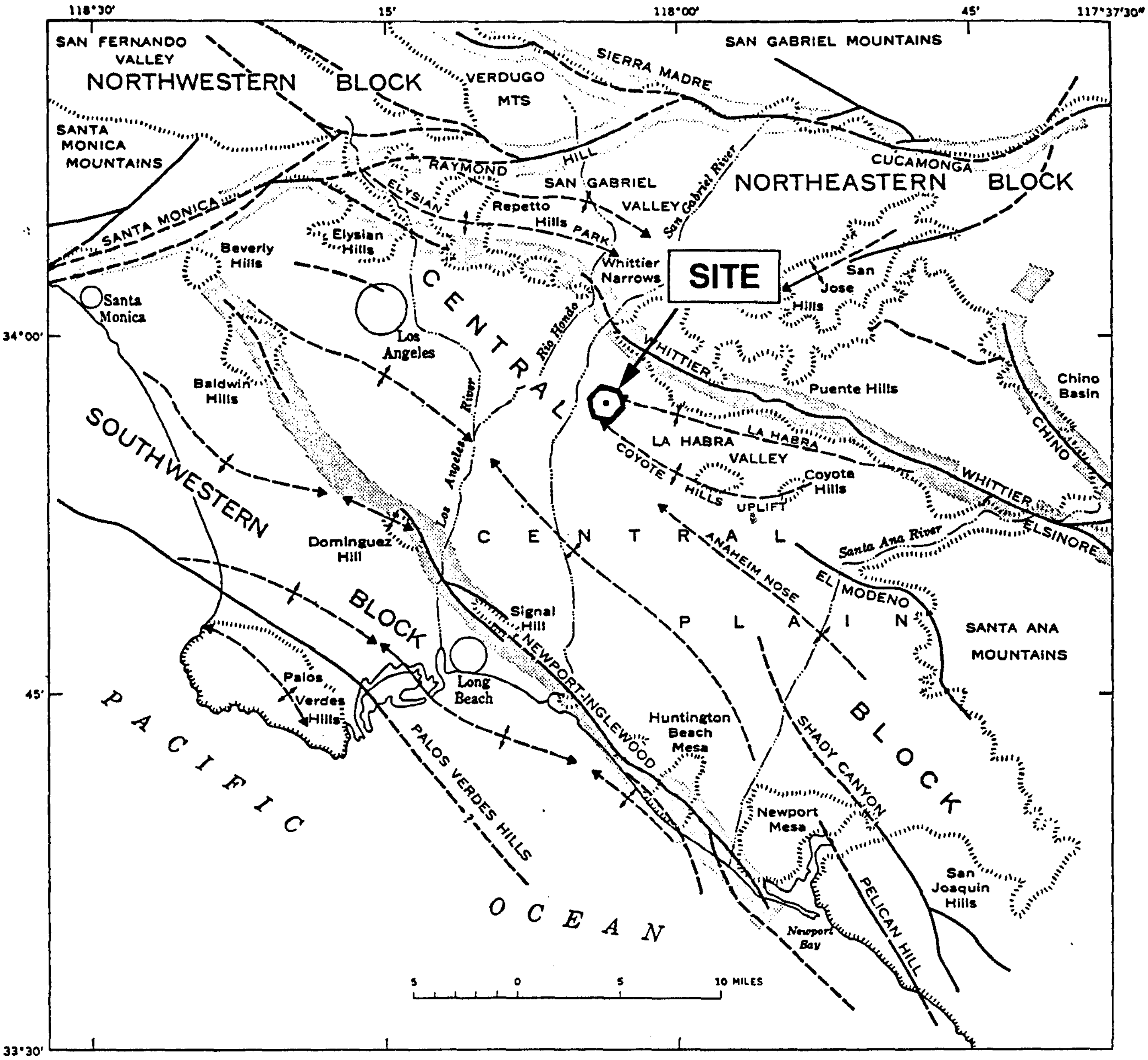
Across Greenleaf Avenue, to the southeast and east of the site are residences. To the northeast is St. Paul's High School. The features which border the site most immediately are the school's athletic fields and parking lot. Behind St. Paul's is a large office complex which is currently only being partially used by Primo Warehouse Distributors.

2.4 PHYSICAL CHARACTERISTICS

2.4.1 Regional Geology

The WDI site is located northwest of the Santa Ana Mountains, a dominant part of the northern Peninsular Ranges of coastal southern California and one which forms the eastern margin of the Los Angeles basin (Figure 2-4).

Situated in the central block of the Los Angeles Basin, the WDI site is bound on the northeast by the La Habra syncline and on the southwest by the



EXPLANATION

WHITTIER

Fault or fault zone
Dashed where approximately located; queried where doubtful

Anticline
Dashed where approximately located

Syncline
Dashed where approximately located

Boundary of structural block

N

SOURCE: Adapted from Yerkes, R.F., et. al. (1965).

Figure 2-4

LOS ANGELES BASIN PHYSIOGRAPHIC AND MAJOR STRUCTURAL FEATURES

Coyote Hills (Santa Fe Springs) anticline (Figure 2-5) in an area commonly referred to as the Santa Fe Springs Plain. This plain is a gently rolling topographic feature which has probably been warped by the Santa Fe Springs - Coyote Hills anticlinal system and dips gently both to the northeast toward Whittier and to the southeast toward the Downey Plain. The difference in elevation ranges from 100 to 175 feet above sea level (DWR 1961). The surface of the Santa Fe Springs Plain and the Coyote Hills reflects a structural high which trends northwest from the Coyote Hills in Orange County and is primarily developed in underlying formations of Miocene and Pliocene age. In these sediments, the uplift consists of anticlinal folds which contain the Santa Fe Springs, Leffingwell, and West Coyote oil fields. The San Pedro and Lakewood formations are similarly folded across the uplift, and the folds developed in these sediments generally correspond to the underlying structures.

The Lakewood formation is exposed on-site at the surface and includes what has previously been termed "terrace deposits," "Palos Verdes sand," and "unnamed upper Pleistocene deposits." Maximum thickness of this formation has been measured to be about 340 feet at Lakewood, California (DWR 1961). Materials range in size from cobbles to clay, with fine deposits separating the lenticular sandy and gravelly beds.

2.4.2 Site Topography and Geology

The surface elevation of the WDI site is approximately 160 feet above mean sea level. The main part of the site is situated 10 to 20 feet above the surrounding terrain. Although the land to the west and southwest is fairly level, the land to the northeast drops away at a 30 to 50 percent slope and the land to the southeast of the site drops away at a 10 to 30 percent slope. Surface drainage from the site is generally toward these areas.

The general geology of the WDI site can be examined using the data from Ebasco's 1988 field investigation activities and the WDI Soil Characterization Report. Eleven cross sections each consisting of five to twelve soil boring logs placed side by side were constructed to show the stratigraphic relationships of the WDI site (Figures 2-6, 2-7, 2-8, and 2-9).

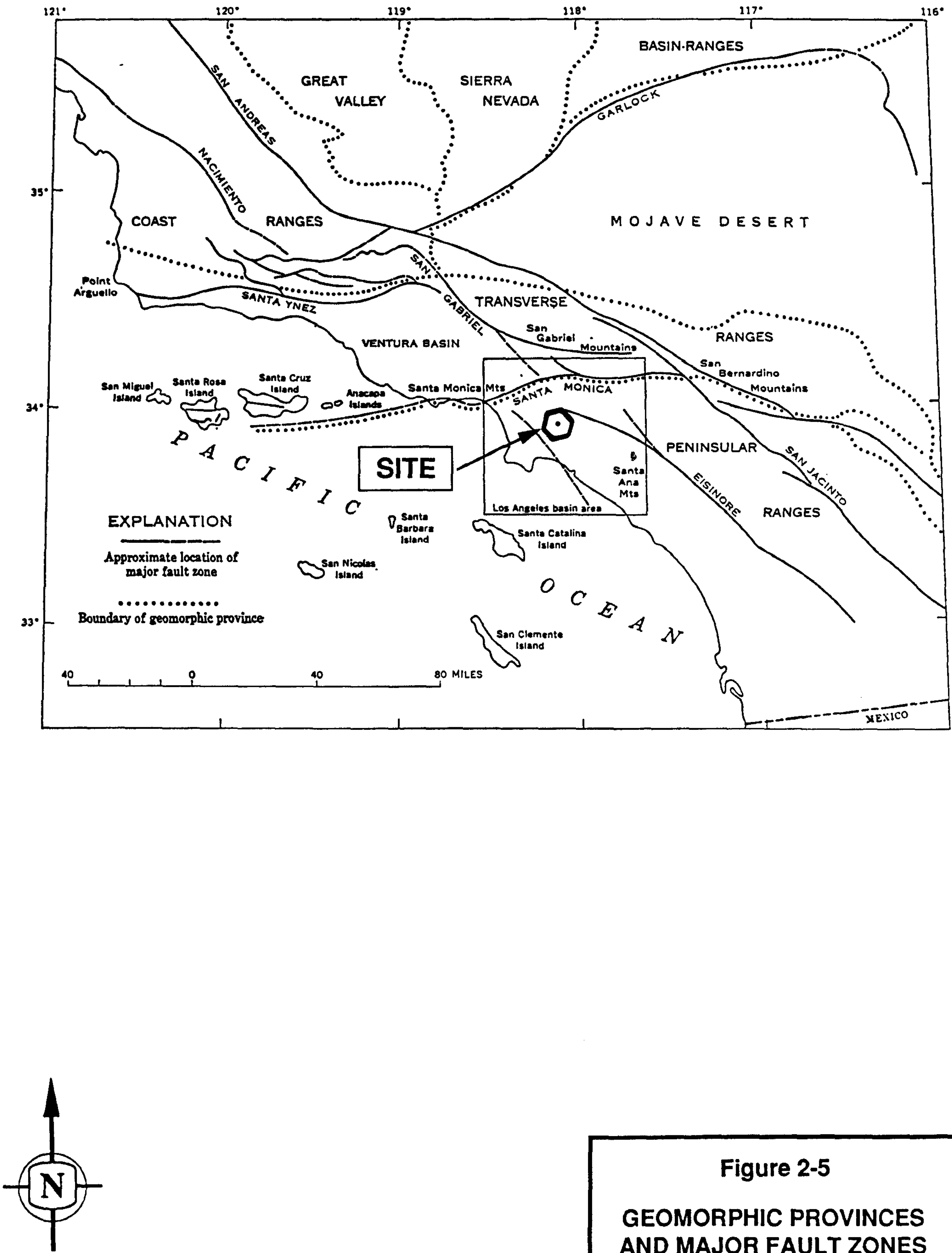
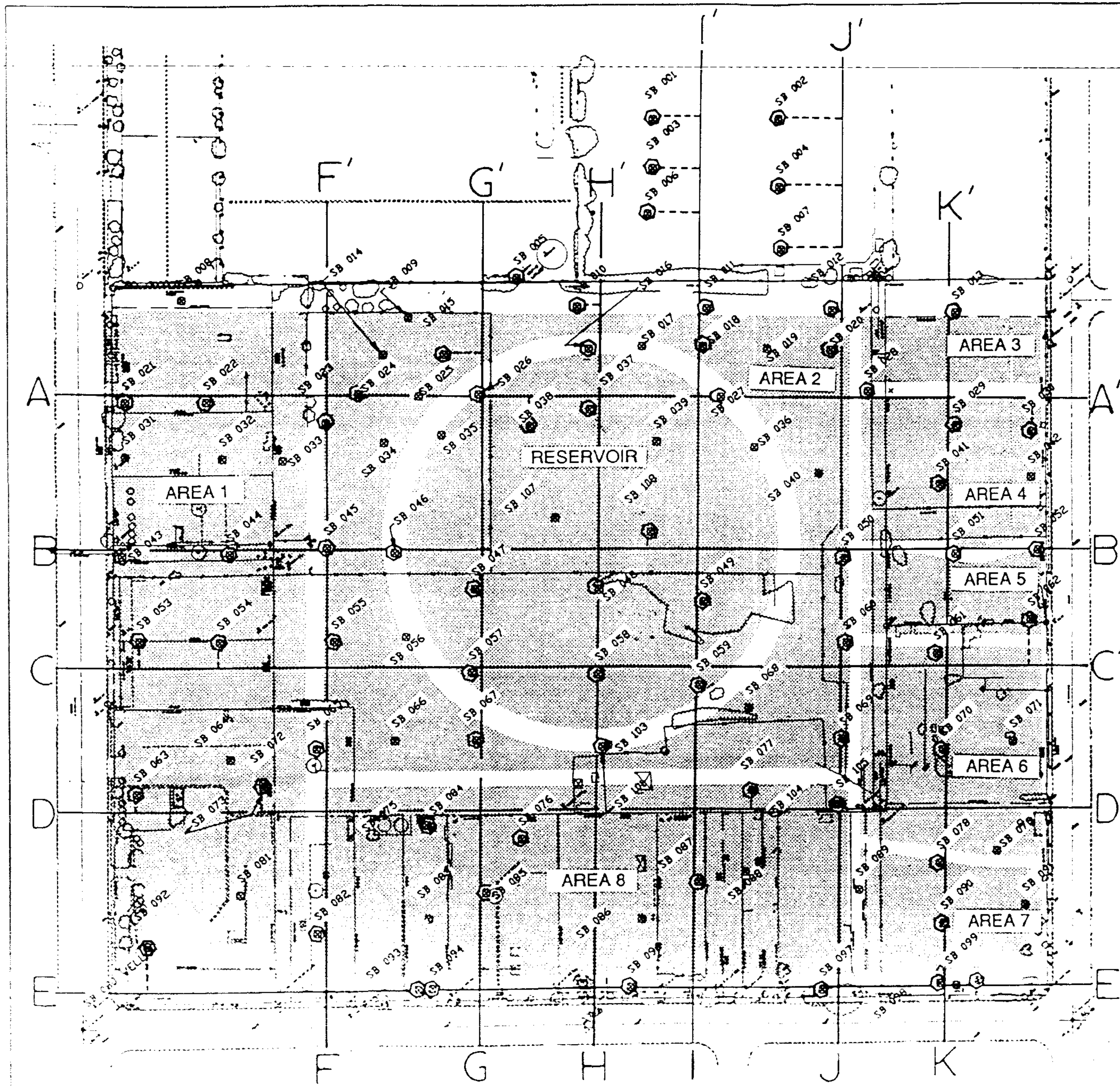
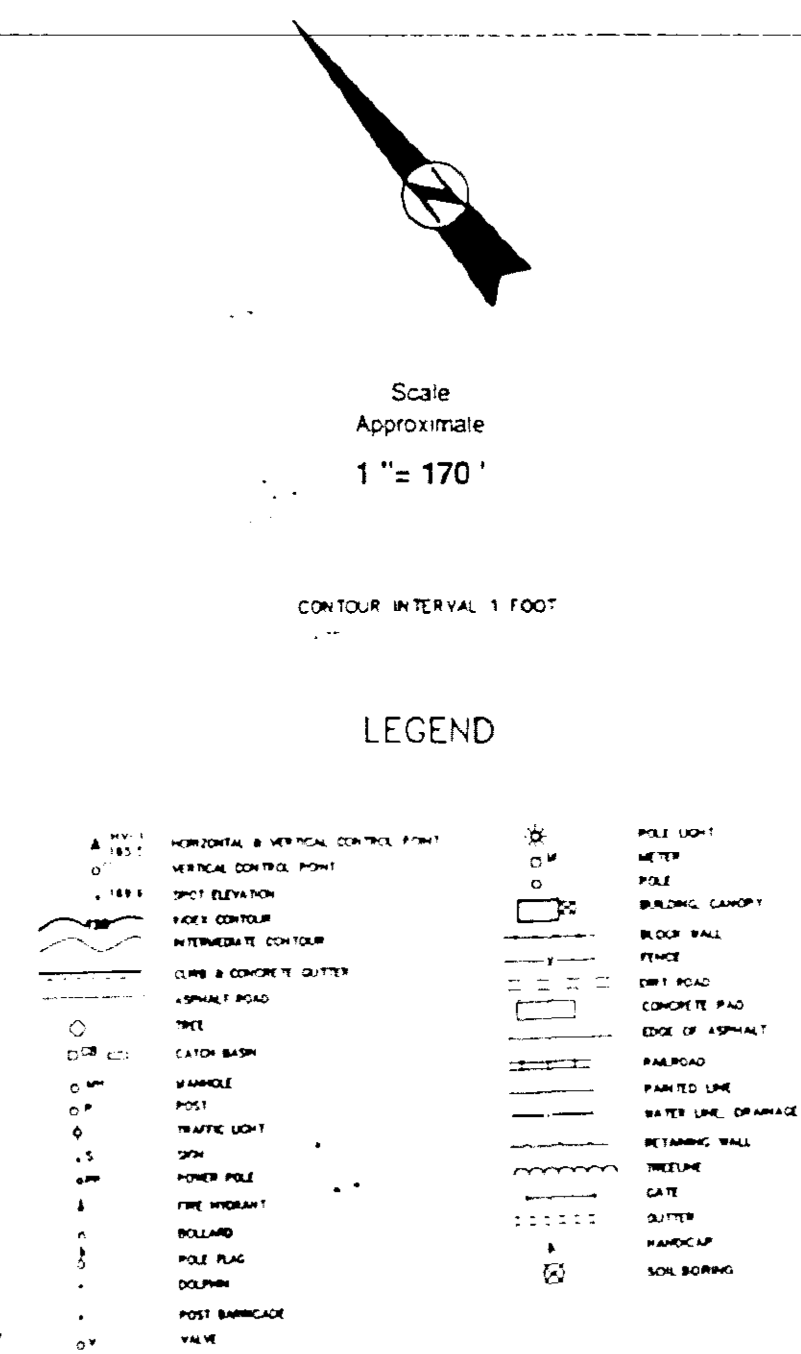


Figure 2-5

GEOMORPHIC PROVINCES AND MAJOR FAULT ZONES

SOURCE: Adapted from Yerkes, R.F., et. al. (1965).





EBASCO SERVICES, INC.

WASTE DISPOSAL, INC. SITE

FIGURE 2-6

LOCATION OF WASTE CONTAINMENT AREAS AND CROSS SECTIONS

FIGURE 2-7

STRATIGRAPHIC CROSS SECTIONS

A'-A'

B-'B'

C'-C'

D'-D'

WASTE DISPOSAL INCORPORATED

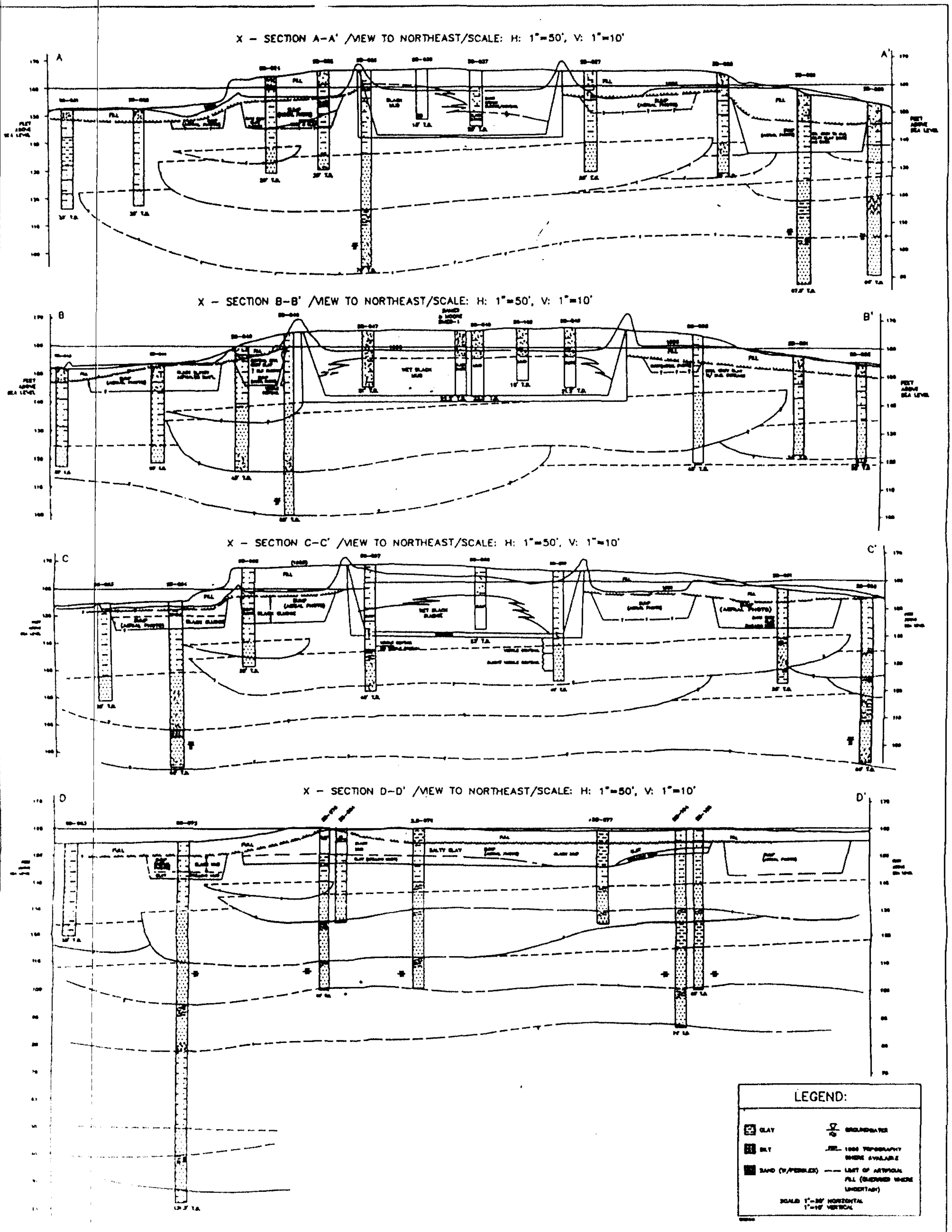


FIGURE 2-8

STRATIGRAPHIC CROSS SECTIONS
E'-E'
F'-F'
G'-G'
H'-H'
WASTE DISPOSAL INCORPORATED

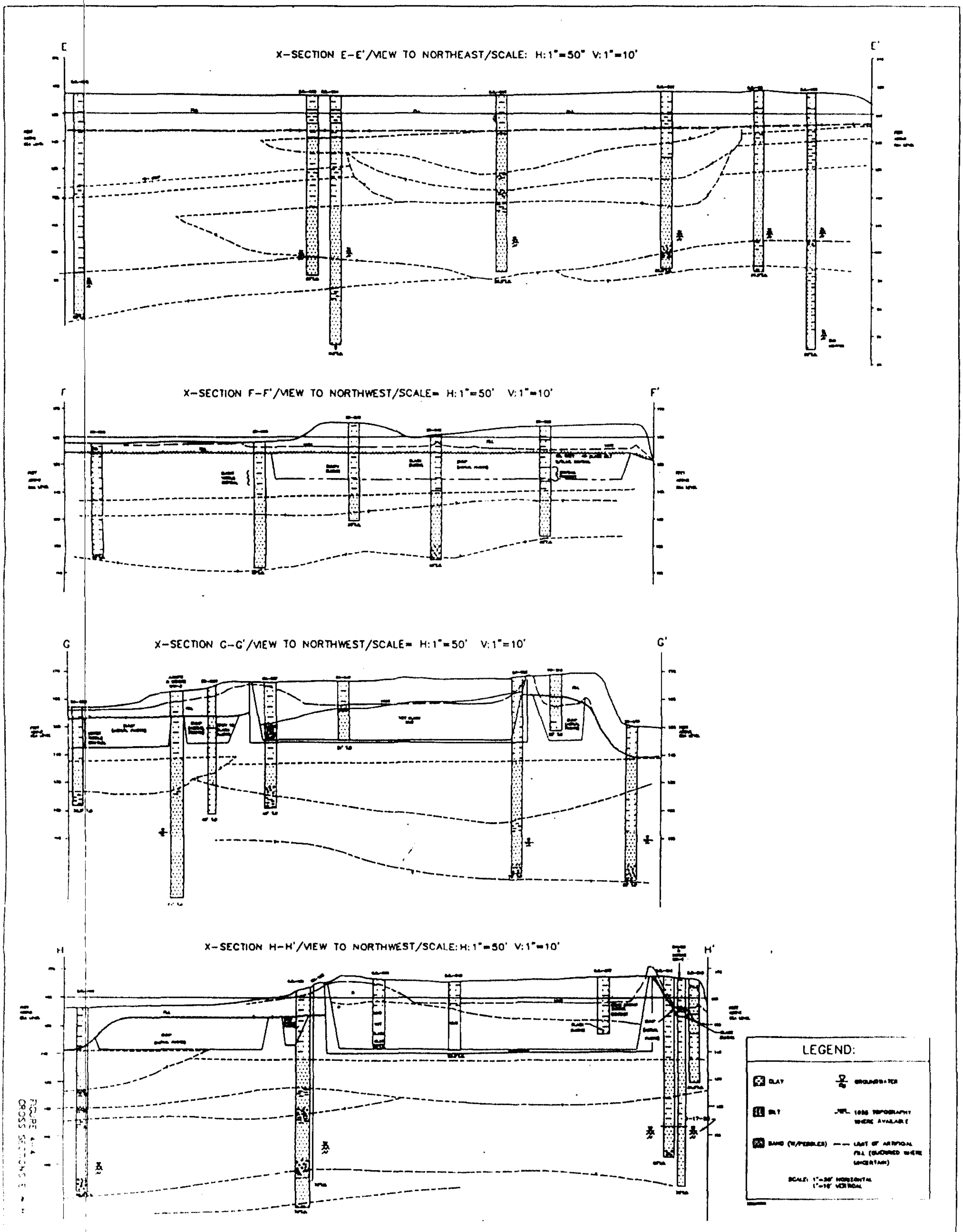


FIGURE 2-9

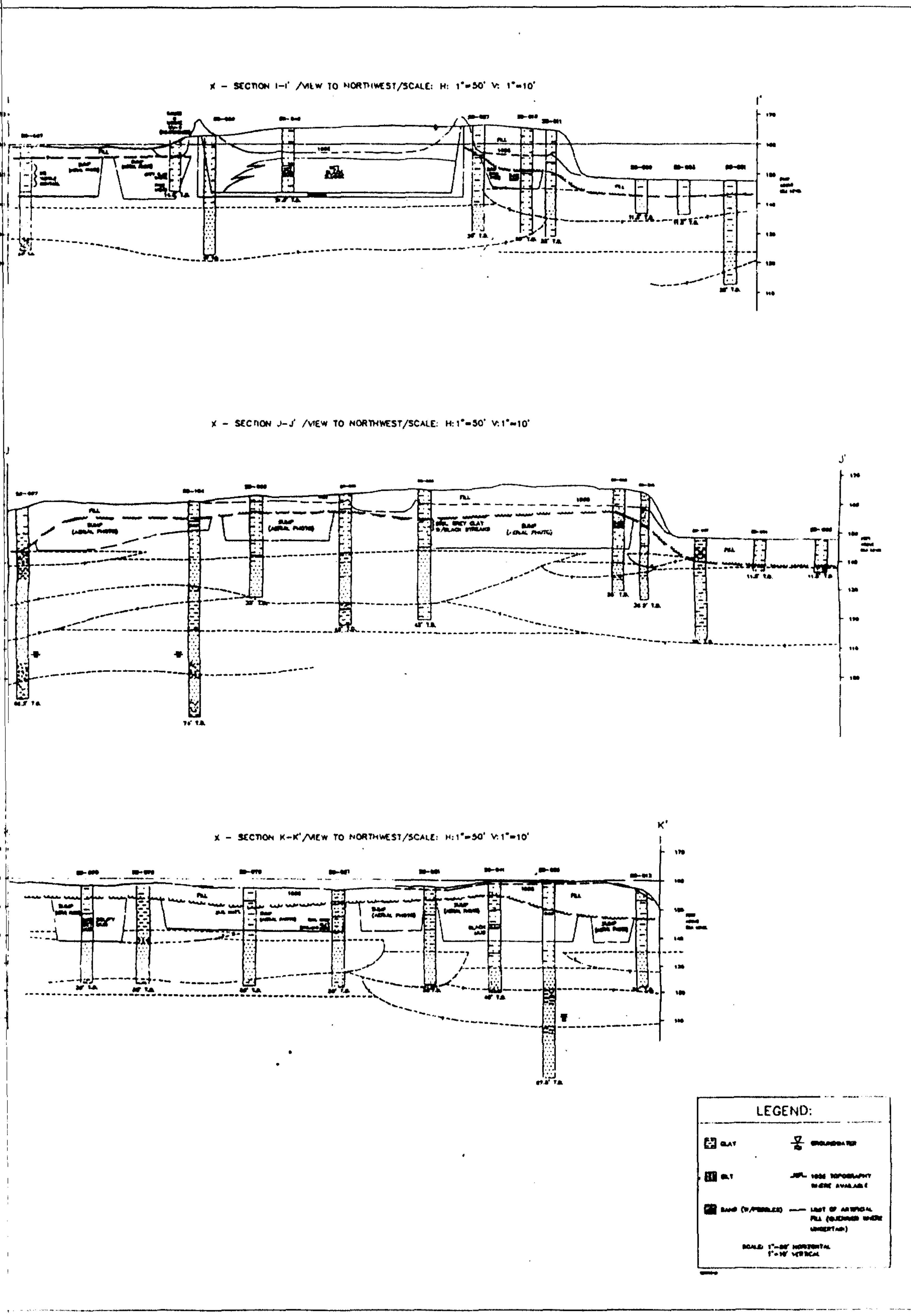
STRATIGRAPHIC CROSS SECTIONS

I'-I'

J'-J'

K'-K'

WASTE DISPOSAL INCORPORATED



Five of the cross sections trend NW-SE and the remaining six cross sections trend NE-SW forming a grid approximately 200 feet by 200 feet across the site.

The WDI soil boring logs and cross sections indicate that WDI strata consist of fluvial deposits. The soils are coarse grained, occasionally pebbly, channelized sands surrounded in places by finer grained, lower energy, and laterally extensive beds. This suggests a braided river system was present. The variable thickness (3 feet to 20 feet) and variable lateral extent (30 feet to 1500+ feet) of individual channel deposits below the site is a result of the continuous active fluvial channel-cutting events.

Figure 2-10 is a generalized, composite, northwest-southeast trending cross section summarizing the stratigraphy as interpreted across the WDI site. The cross section shows:

- Five to 15 feet of artificial fill material covers the entire WDI site.

- Below the fill material is a silt layer ranging from 10 to 25 feet in thickness is also present across the entire WDI site.

- Below the silt layer is a sandy, pebbly, channelized network of braided river deposits that is at least 50 feet thick.

The detailed cross sections shown in Figures 2-7 through 2-9 point out local stratigraphic variations. These variations can be summarized as follows:

- Strata beneath the WDI site apparently dip 2 to 4 degrees to the northwest. This is best illustrated by a five foot thick clay bed overlying a silt layer is present on both sides of the WDI site which is shown on cross section E-E', and which trends NW-SE (Figure 2-8). The difference in elevation of the clay bed and silt layer on opposite sides of the site as well as the lack of apparent dip on NE-SW trending cross sections suggests that NW-SE trending cross section E-E' is parallel to the direction of dip of WDI strata.

TABLE 2-9

CONTAMINANTS FOUND AT
TOXO SPRAY DUST

Contaminant	Depth (in ft)	Concentration	STLC Values[a]	EP Toxicity[a] Limits
Metals (in ppm)				
Aluminum, Al	5-15,35	10500.00 - 20800.00	b	c
Arsenic, As	0-20,35	5.31 - 15.10	5.00	5.00
Barium, Ba	0-20,30-35	103.00 - 263.00	100.00	100.00
Calcium, Ca	0-20,35	5720.00 - 13600.00	b	c
Copper, Cu	0-15,30-35	29.40 - 270.00	25.00	c
Lead, Pb	0-15,35-40	7.14 - 264.00	5.00	5.0
Magnesium, Mg	5-10,35	1090.00 - 9950.00	b	c
Nickel, Ni	5-15,35	20.10 - 26.60	20.00	c
Sodium, Na	5-20,35	616.00 - 958.00	b	c
Thallium, Tl	0-15,35-45	13.70 - 32.60	7.00	c
Vanadium, V	0-20,35-40	30.00 - 70.40	24.00	c
Molybdenum, Mo	0-5,20,40	1.10 - 2.27	250.00	c
Volatiles (in ppb)				
Methylene Chloride	0-10,20,35	1.00 - 42.00	b	c
1,1-Dichloroethene	35	3.00	b	c
Benzene	35	6.00	b	c
Toluene	0-5,35	2.00 - 22.00	b	c
Ethylbenzene	35	11.00	b	c
Xylene (total)	35	26.00	b	c

[a] Neither the waste extraction test (WET) to determine the STLC nor the EP Toxicity test have been conducted on WDI soil samples at this time. These values are provided for reference purposes only. Generally, if the concentration of a metal is 10 times the STLC or EP Toxicity test in soil it can be considered likely to occur in hazardous concentrations in leachate.

[b] Soluble Threshold Limit Concentrations (STLC) values have not been established for these metals and organics under Title 22 of the California Code of Regulations (CCR).

[c] EP Toxicity limits have not been established for these metals and organics under the Code of Federal Regulations (CFR).

- A clay and silt layer about 10 feet thick and from 30 to 40 feet below ground level is present under approximately 25 percent of the site. This layer is found predominantly at the southeast end of the site and is interbedded with the sandy, pebbly, braided river deposits. This layer may at one time have been deposited over the entire study area.

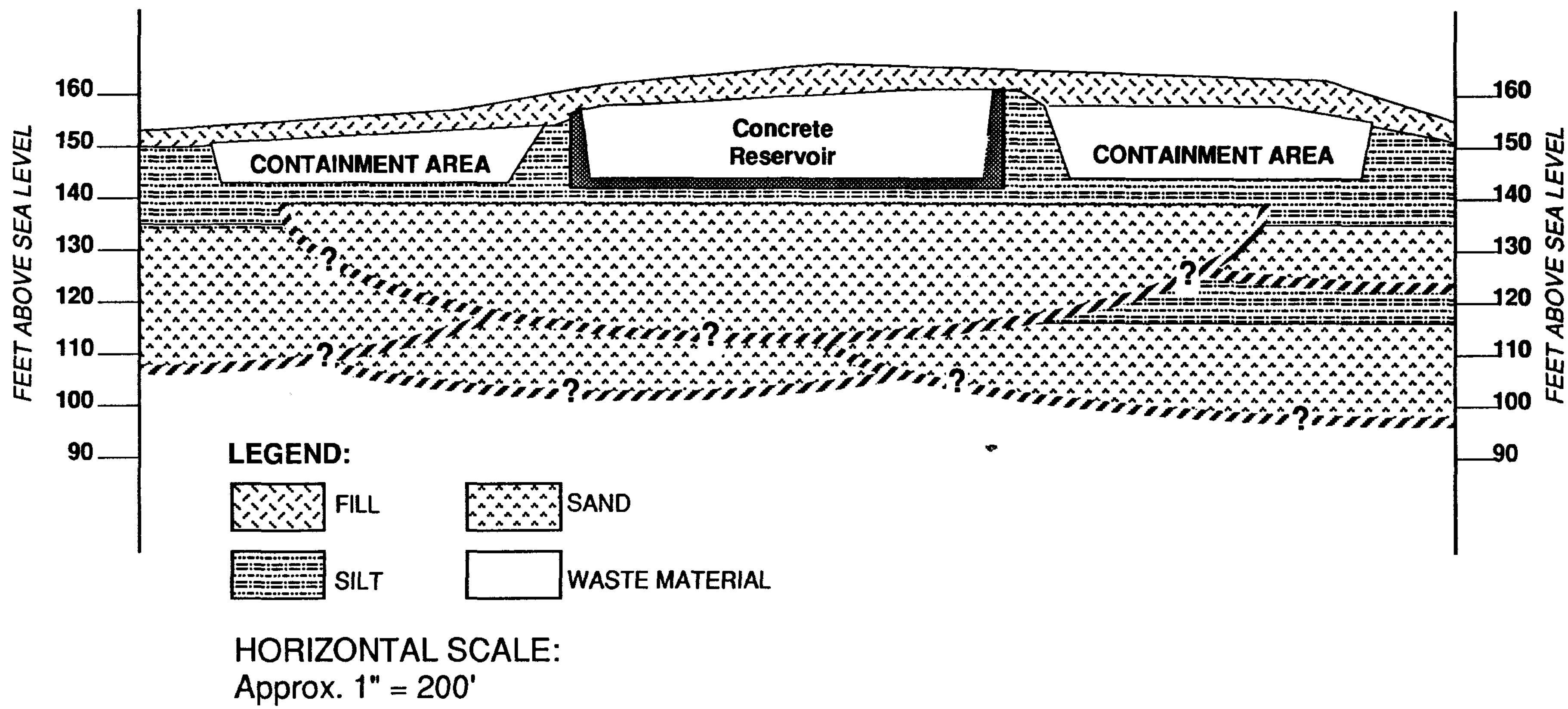
- Over most of the site the apparent direction of channeling, and therefore the apparent direction of sediment transport, is in a NE-SW direction. This is suggested by the cross sections. In a general sense, the NW-SE trending cross sections appear to transect, or cut across, individual channel profiles, whereas the NE-SW trending cross sections appear to trend parallel to the axis of individual channels. Cross sections E-E' and F-F' (Figure 2-8) are good examples of this. Cross section E-E' apparently transects individual channels and cross section F-F' apparently trends parallel to the axis of various channels. An exception to this apparent NE-SW direction of sediment transport can be found in the eastern corner of the site where the network of channels is more unpredictable (see cross section K-K' on Figure 2-9.

2.4.3 Regional Hydrogeology

The WDI site is situated in the Whittier Area of the Central Groundwater Basin (Figure 2-11). The Whittier Area extends from the Puente Hills south and southwest to the axis of the Santa Fe Springs-Coyote Hills uplift. The western boundary is an arbitrary line separating the Whittier Area from the Montebello Forebay Area; the eastern boundary is the Los Angeles-Orange County line (DWR 1961).

The Whittier Area is overlain by the La Habra Piedmont Slope and part of the Santa Fe Springs Plain and the Coyote Hills. The known water-bearing sediments, extending to a depth of about 1,000 feet (800 feet below sea level), include Recent alluvium and the Lakewood and San Pedro Formations. A part of the underlying Pliocene and older deposits may also contain water of good quality. Electric logs of oil wells indicate fresh water at a greater depth than has been penetrated by water wells.

Figure 2-10
GENERALIZED CROSS SECTION
ACROSS WDI SITE



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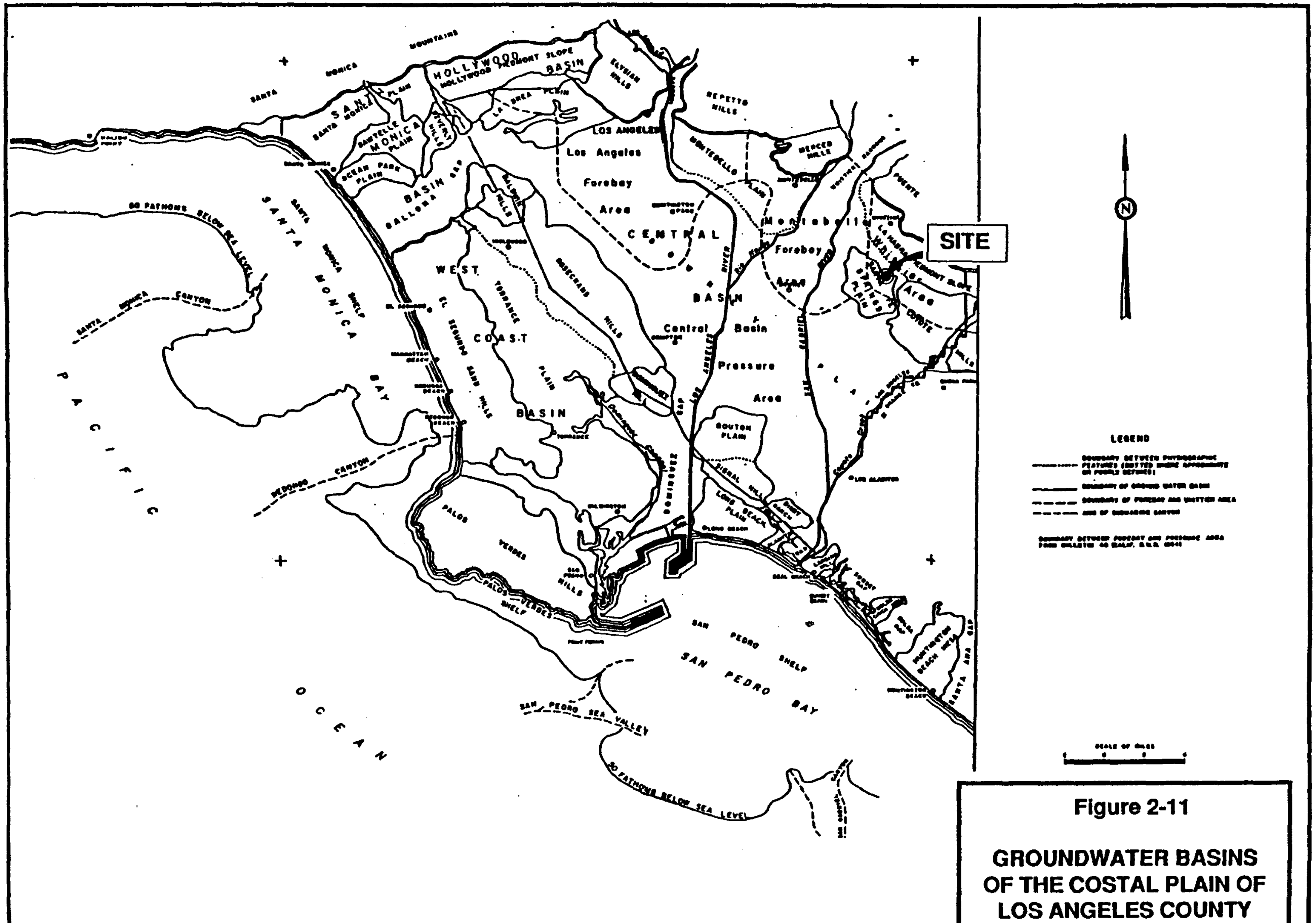


Figure 2-11

GROUNDWATER BASINS OF THE COSTAL PLAIN OF LOS ANGELES COUNTY

SOURCE: Adapted from DWR (1961).

Recent alluvium in the Whittier Area consists of a thin layer of sand, gravel, and clay, which extends into the western portion of the area from the Montebello Forebay Area. The sediments are 80 feet thick near the western boundary of the area, and thin out to the east. The Recent alluvium contains a portion of the Bellflower aquiclude.

The Bellflower aquiclude in the Recent alluvium consists of clay and sandy clay ranging from 10 to over 40 feet in thickness (Table 2-2). Beneath the Santa Fe Springs Plain, the Bellflower aquiclude is part of the undifferentiated Lakewood formation. Lack of data in many parts of the area, where the Lakewood formation is exposed at the surface, make it difficult to define the thickness, extent, and composition of this aquiclude. Where data are available, the Bellflower aquiclude is clay and sandy clay averaging 20 feet in thickness and extending down to a depth of about 70 feet below the ground surface. According to the Department of Water Resources (1961) the base of the Bellflower aquiclude as it occurs beneath Santa Fe Springs is approximately 100 feet above mean sea level (msl).

The degree to which ground water can be transmitted through the Bellflower aquiclude depends on the thickness and composition of the aquiclude or the location and depth of improperly sealed oil and/or water wells. While the aquiclude appears to be continuous over most of the Whittier Area, it may be either absent in some areas or so thin and discontinuous that groundwater can be transmitted through it at an appreciable rate.

In addition to containing the Bellflower aquiclude, the Lakewood formation also contains the Artesia aquifer. The Artesia aquifer is mostly sand with some interbedded clay and near Santa Fe Springs has a maximum thickness of 20 feet. According the California Department of Water Resources (1961), the average elevation of the base of the Artesia aquifer beneath Santa Fe Springs is 80 feet msl.

The Gage aquifer is the major water-bearing member of the Lakewood formation in the Whittier Area. It has been delineated only in the southern portion of the area and near the Los Angeles-Orange County line, where it consists of about 30 feet of sand with some interbedded clay, and has a maximum depth

TABLE 2-2

DEPTH, THICKNESS AND GEOLOGY OF AQUIFERS
IN VICINITY OF WDI SITE

Formation	Water-Bearing Zone	Thickness (in feet)	Depth (in feet)	Upper Elevation (in feet ± msl)	Geologic Characteristics
Lakewood	Bellflower Aquiclude	10-40	70	+ 100	Clay and sandy clay
Lakewood	Artesia Aquifer	20 (max.)	--	+ 80	Sand, interbedded clay
Lakewood	Gage Aquifer	30	150	+ 0-50	Sand, interbedded clay
San Pedro	Hollydale Aquifer	10-25	100	+ 85-100	Sand and gravel, small amount of clay
San Pedro	Jefferson Aquifer	20-40	350	--	Sand and gravel, small amount of clay
San Pedro	Lynwood Aquifer	50-100	460	- 300 (at max. depth)	Sand and gravel, small amount of clay
San Pedro	Silverado Aquifer	100-200	650	- 500 (at max. depth)	Sand and gravel
San Pedro	Sunnyside Aquifer	150-200	1000	- 700 (at max. depth)	Sand and gravel, interbedded clay

Source: Adapted from DWR (1961).

3642E

of about 150 feet below ground surface (DWR 1961). The elevation of the base of the Gage aquifer is between 0 and 50 msl.

The San Pedro formation underlies the entire Whittier Area, where it attains a maximum thickness of about 850 feet and extends down to a depth below ground surface of about 920 feet. The formation is composed of sand and gravel with interbedded clay, all probably of marine origin. Clay members separate the sands and gravels comprising the aquifers over most of the basin. The San Pedro formation contains the Hollydale, Jefferson, Lynwood, Silverado and Sunnyside aquifers. An extensive unconformity brings the aquifers of the San Pedro formation into contact with those of the Lakewood formation along the northern boundary of the area and along the edge of the Coyote Hills.

The Hollydale aquifer has been identified only in the western part of the Whittier Area. It may be present over the rest of the area, but data are lacking. It ranges in thickness from 10 to 25 feet and consists of sand and gravel with a small amount of interbedded clay. It appears to reach a maximum depth of about 100 feet below ground surface (elevation 50 feet msl). It is merged with the overlying Gage aquifer in the vicinity of South Whittier. If present beneath the WDI site, the Hollydale aquifer would first be encountered from 85 to 100 feet below ground surface.

The Jefferson aquifer ranges in thickness from 20 feet to 40 feet and consists of sand and gravel with a little interbedded clay. It extends over most of the Whittier Area and reaches a maximum depth of about 350 feet below ground surface (100 feet below sea level). In the western part of the area, near the boundary with the Montebello Forebay, the Jefferson aquifer merges with the overlying Hollydale aquifer.

The Lynwood aquifer is present throughout the Whittier Area. It ranges in thickness from 50 to 100 feet and consists of sand and gravel with some interbedded clay. It extends to a maximum depth of about 460 feet below ground surface (300 feet below sea level).

The Silverado aquifer has been identified over all of the Whittier Area. It consists of 100 to 200 feet of sand and gravel with finer grained phases in some areas. It extends to a depth of about 650 feet below ground surface (500 feet below sea level).

The Sunnyside aquifer also has been identified throughout the Whittier Area. It consists of 150 to 200 feet of sand and gravel with some interbedded clay. It is the lowest of the aquifers identified, reaching a maximum depth of about 1,000 feet (700 feet below sea level). The gravels exposed in the Coyote Hills and along the north side of the area are believed to be surface outcrops of the Sunnyside aquifer.

As implied by the preceding discussion, as many as seven aquifers and one aquiclude may be present beneath the WDI site (Figures 2-12 and 2-13, Tables 2-3 and 2-4).

2.4.4 Regional Groundwater Use

Regional groundwater use (use within 3 miles of the WDI site) has been classified according to the potential which may exist for surrounding populations to ingest contaminants from the WDI site. This approach has been taken to improve RI/FS effectiveness and performance of comprehensive risk assessment activities. This is not meant to imply that any of the following groundwater systems have been contaminated. Until field sampling and analysis activities are initiated, this cannot be determined. This classification is intended as a screening tool only to enable the RI/FS team to properly assign priorities, evaluating the potential impacts to the most critical and/or susceptible elements of area groundwater supplies first.

The classification of regional groundwater includes the following:

Priority 1

o Municipal

- Domestic or recreational use of first aquifer beneath site
- Domestic or recreational use of aquifer(s) which are hydraulically connected to first aquifer

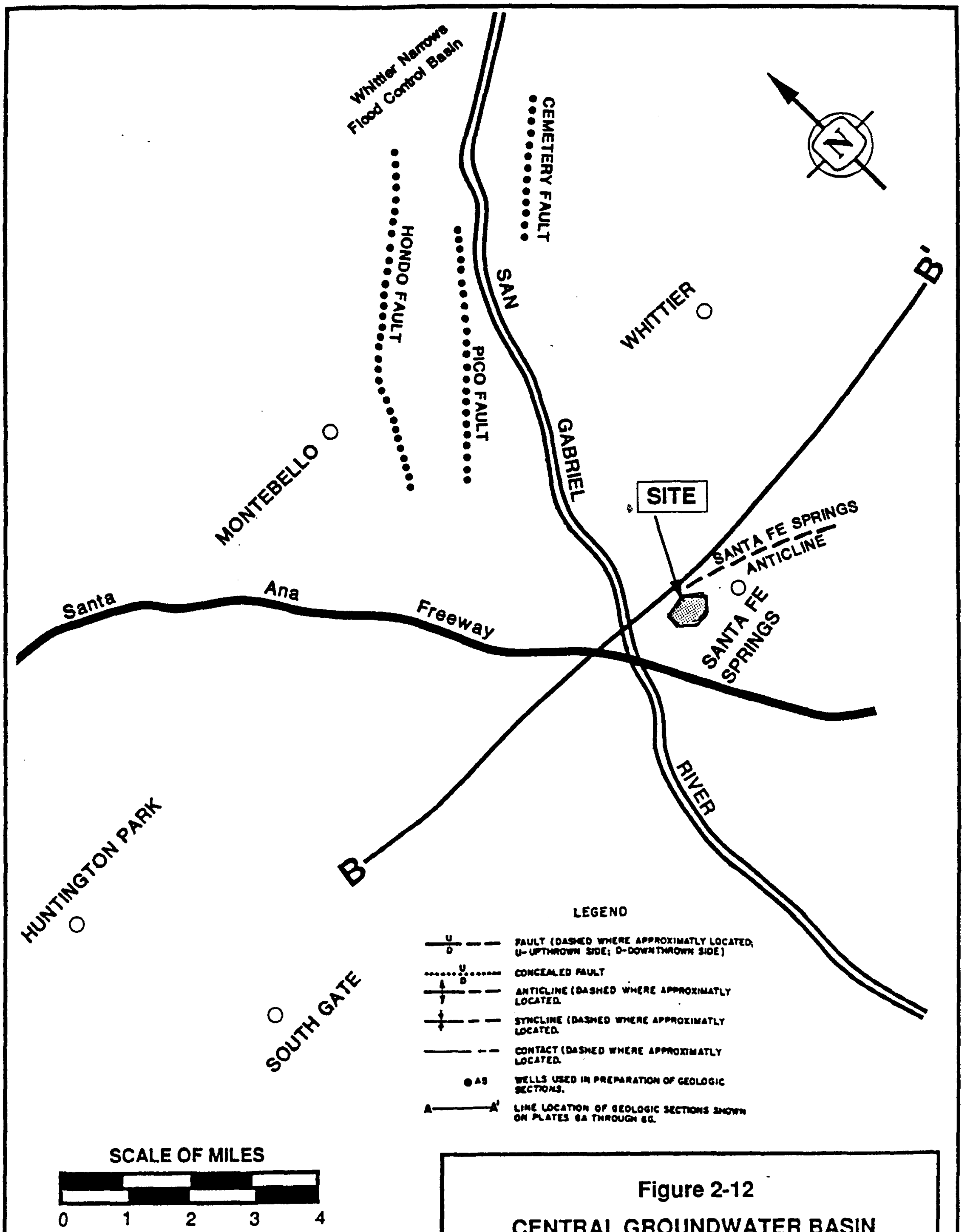


Figure 2-12

CENTRAL GROUNDWATER BASIN SHOWING CROSS-SECTION LOCATION

SOURCE: Adapted from DWR (1961).

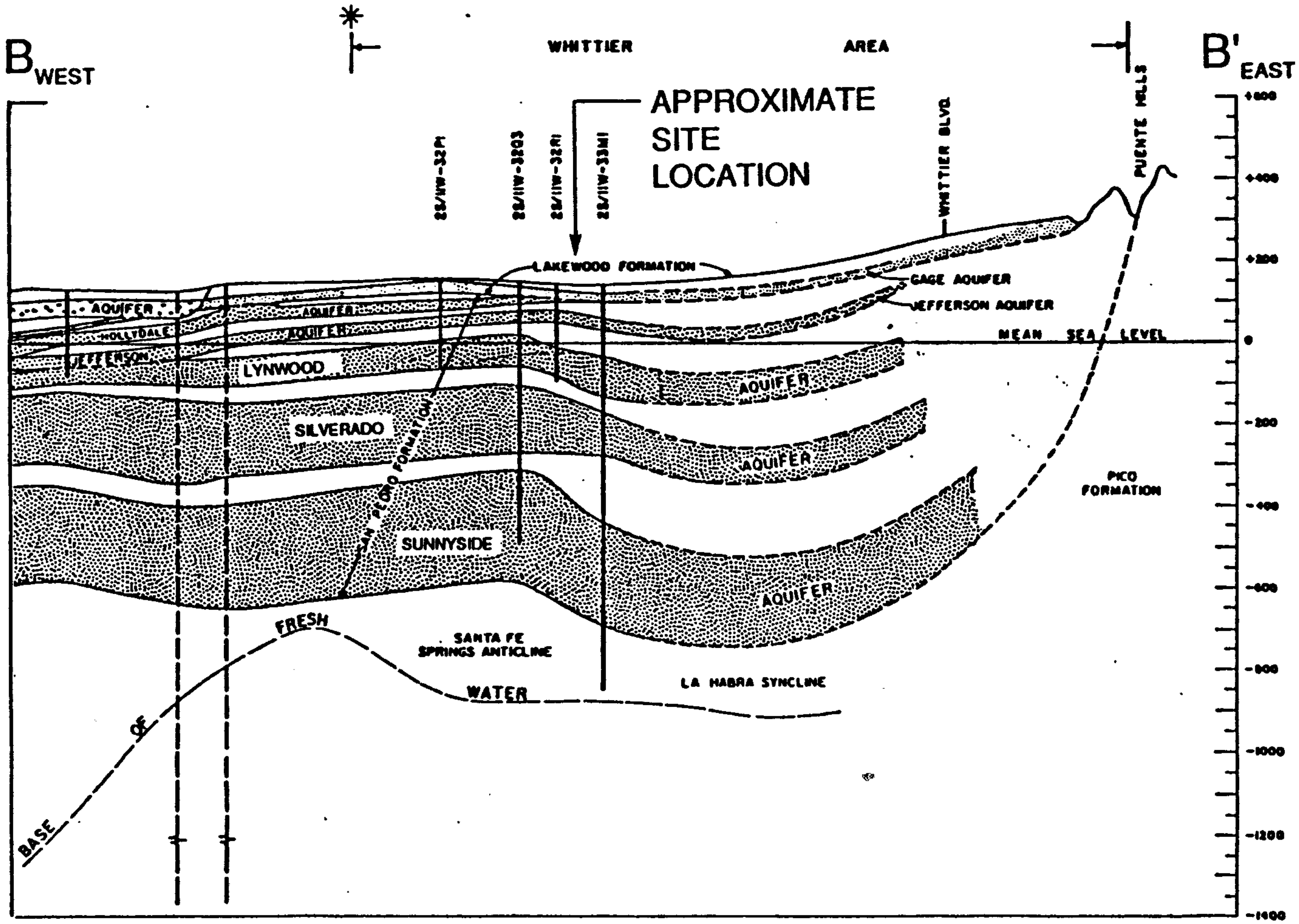


Figure 2-13

WHITTIER AREA CROSS-SECTION VIEW B-B' OF WATER BEARING STRATA

SOURCE: Adapted from DWR (1961).

TABLE 2-3

TRANSMISSABILITY TESTS FOR AQUIFERS
IN VICINITY OF WDI SITE

Observation Well(s)	Pumping Well(s)	Date of Test	Type of Test	Aquifer(s)	Transmissability (gal/day/ft)	Estimated Horizontal Permeability (gal/day/sq/ft)	Storage Coefficient	Leakage Coefficent (gal/day/sq/ft)	Estimated Vertical Permeability (gal/day/sq/ft)
	2S/11W-7J2	4/5/57	Recovery	Pleistocene and Recent	130,000	575	-	-	-
	2S/11W-8NI	4/5/57	Recovery	Pleistocene and Recent	53,000	246	-	-	-
2S/11W-18K2	2S/11W-18Q4	8/12/59	Drawdown	Recent and and Lower Pleistocene	410,000	2,830	1.7×10^{-3}	-	-
2S/11W-18P2	2S/11W-18Q2	2/24/59	Drawdown	Lower Pleistocene	690,000	3,300	2.3×10^{-3}	-	-
2S/11W-18Q4	2S/11W-18Q2	2/24/59	Drawdown	Lower Pleistocene	190,000	1,195	2.9×10^{-4}	-	-
2S/14W-19C1	2S/14W-19C2	6/28/50	Drawdown	Lower Pleistocene	170,000	600	2.9×10^{-3}	1.2×10^{-7}	1.2×10^{-6}
	2S/14W-27J1	7/7/50	Recovery	Silverado	92,500	1,050	-	-	-
2S/15W-34A3	2S/15W/34A1	6/2/49	Recovery	Gardena and Lynwood	82,600	1,173	4.2×10^{-5}	1.9×10^{-8}	1.2×10^{-6}

Source: Adapted from DWR (1961).

3642E

TABLE 2-4

PERMEABILITY VALUES ASSIGNED TO AQUIFERS IN VICINITY OF WDI SITE

Media Type	Permeability Value
Sandy Clay (includes gravelly clay, clay and sand, clayey sand, etc.)	50 gpd/ft^2
Sand	500 gpd/ft^2
Gravel (includes sand and gravel)	
Gaspur Aquifer	4000 gpd/ft^2
Ballona Aquifer	2000 gpd/ft^2
Marine Gravels (Silverado, Sunnyside, and portion of Lynwood aquifers)	1500 gpd/ft^2
Nonmarine Gravels (Gardena, Artesia, Exposition, Jefferson, Hollydale, and portion of Lynwood Aquifer)	1000 gpd/ft^2
Gravel with Clay Streaks	one-half of above values for gravel
Clay	0

Source: Adapted from DWR (1961).

- o Private Institution (School, Hospital, etc.)
  - Domestic or recreational use of first aquifer
  - Domestic or recreational use of hydraulically connected aquifers
- o Private Individual
  - Domestic or recreational use of first aquifer
  - Domestic or recreational use of hydraulically connected aquifers

Priority 2

- o Private Institution (Business, Farm, etc.)
  - Industrial, commercial or agricultural use of first aquifer
  - Industrial, commercial or agricultural use of hydraulically connected aquifers
- o Municipal
  - Industrial, commercial or agricultural use of first aquifer
  - Industrial, commercial or agricultural use of hydraulically connected aquifers
- o Private Individual
  - Industrial, commercial or agricultural use of first aquifer
  - Industrial, commercial or agricultural use of hydraulically connected aquifers

Priority 3

- o Domestic or recreational use of aquifer not hydraulically connected
- o Industrial, commercial, or agricultural use of aquifer not hydraulically connected
- o Other (i.e., subsurface storage of imported water)

Priority 1 groundwater wells in the area of the WDI site are described below:

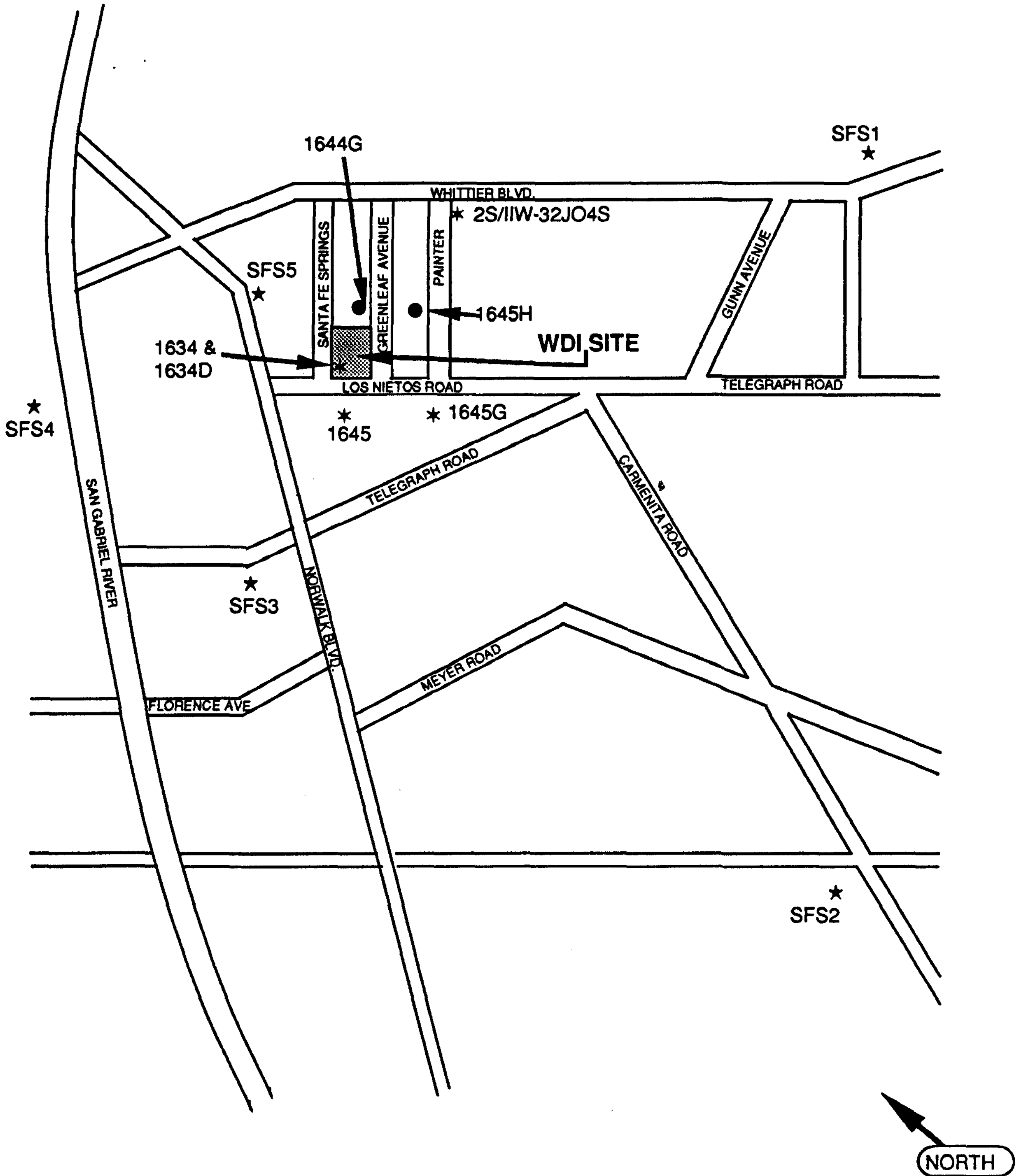
1. Municipal water supply wells which utilize the first aquifer (shallowest groundwater) beneath the WDI site. At present, no nearby groundwater wells have been identified which are owned and/or operated by a municipality and which utilize groundwater from the first aquifer.

2. Municipal water supply wells which pump from aquifers hydraulically connected to the first aquifer. Although it has not been definitively established that the aquifers in the Lakewood formation are hydraulically connected naturally to those in the San Pedro formation, early researchers concluded that in the vicinity of the WDI site the aquifers within each of these formations may be hydraulically connected (Department of Water Resources 1961). The large number of oil wells in the area and the presence of multi-perforated groundwater wells may also act as artificial conduits to conduct liquids between aquifers. Therefore, it is assumed that a well completed in any aquifer possesses a potential for being hydraulically connected to the first aquifer below the WDI site.

   Four out of the 5 wells which the City of Santa Fe Springs utilizes in order to obtain 60 percent of its groundwater (40 percent is purchased from the Metropolitan Water District) are located within 3 miles of the WDI site (Figure 2-14, Table 2-5). One is located downgradient of the WDI site. However, both the groundwater which the city pumps and that which it buys are fed directly into the same piping network for distribution (Price 1985a). A small amount of blending is done in a 4 million gallon reservoir. This system has 4200 connections which are both residential and industrial.

3. Private institutions or individuals using first aquifer. Two wells which are located within 3 miles upgradient of the WDI site are known to have used this first aquifer at some time in the past (Table 2-6). Neither is believed to be currently active.

4. Private institutions or individuals using aquifers hydraulically connected to the first aquifer. Nine wells which are located within 3 miles of the WDI site, including four which are downgradient of the site, and have been completed in an aquifer which may be hydraulically connected to the first aquifer, are known to have been used at some time in the past (Table 2-7). One is believed to be abandoned. The status of the other eight is unknown at this time.



LEGEND:

- ★ SFS = SANTA FE SPRINGS MUNICIPAL WELL
- ● PRIVATE WELLS IN FIRST AQUIFER
- ✶ PRIVATE WELLS IN CONNECTED AQUIFERS

NOT TO SCALE

SOURCE: CBWA (1985), Zielbaver (1985), Nagler (1985)

Figure 2-14

SITE AND VICINITY GROUNDWATER WELLS

TABLE 2-5

CITY OF SANTA FE SPRINGS
GROUNDWATER WELLS

Well No.	Distance and Direction from WDI (miles)	Total Depth (ft.)	Depth to Water (ft.)	Screened Interval(s) and Aquifer(s)	Comments
SFS # 1	≦ 3 East	NA	NA	Silverado, Sunnyside	--
SFS # 2	≦ 3 South	NA	NA	Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside	--
SFS # 4	≦ 3 Northwest	NA	NA	Lynwood, Silverado Sunnyside	--
SFS # 304	> 3 Southwest	NA	NA	Silverado	--
SFS # 309	≦ 3 Northwest	NA	NA	Sunnyside	Less than 25% of all GW pumped by SFS

NA - Not Available.

Source: Adapted from Price (1985b).

TABLE 2-6

PRIVATE GROUNDWATER WELLS COMPLETED IN
FIRST AQUIFER(S) BELOW WDI SITE

LACFD Well Number	DWR Well Number	Well Owner	Distance and Direction from WDI (in ft)	Total Depth (ft)	Depth to Water (ft)	Screened Interval(s) & Aquifers (in ft)	Uses	Comments
1644G	2S/11W-32K5	SFS	1000-1500 to E (Near S.P.H.S.)	84 [1]	32.6 [2]	40-58; 88-102 131-139; 604-628	NA	—
1645H	2S/11W-32Q3	Charles Boring	775 to SE	500-648 [3]	43.6 [2]	40-58; 88-102 131-134; 535-545 558-562; 567-570 590-594; 604-624	Public Supply & Irrigation (1925-1951) Capped (1957)	Velocity 40 ft/mile to SW. Is shown active as of 1979.

[1] LACFD (1970).
[2] Farag (1984).
[3] LACFD (1959).
NA - Not available.

3682E

TABLE 2-7

PRIVATE GROUNDWATER WELLS COMPLETED IN AQUIFER(S) WHICH MAY BE HYDRAULICALLY CONNECTED TO AQUIFER(S) BELOW THE WDI SITE

LACFD Well Number	DWR Well Number	Well Owner	Distance and Direction From WDI (in ft)	Total Depth (ft)	Depth To Water (ft)	Screened Interval(s) & Aquifers (in ft)	Uses	Comments
NA	2S/11W-32J04S	Whittier Union H.S. District	3000 to S (Sierra H.S.)	804 [1]	NA	228 (Lynwood) [1] Sunnyside	Domestic and Irrigation [1]	—
NA	2S/11W-30R03S	SFS	Within 3 miles	NA	NA	Silverado Sunnyside	Domestic	—
NA	2S/12W-25Q05S	SFS	Within 3 miles	NA	NA	Silverado	Domestic	—
NA	3S/17W-06D039	SFS	Within 3 miles	NA	NA	Lynwood Silverado Sunnyside	Domestic	—
1645	NA	SCE	600 to W	228 (Caved to 60) [2]	NA	NA	NA	Abandoned
1645G	NA	NA	1000 to SSW	111 [2]	NA	NA	NA	—
1645A	NA	Texas Oil Company	NA	55 [2]	NA	NA	NA	—
1634	NA	NA	500 to W	210 [2]	NA	NA	NA	—
1634D	NA	NA	500 to W	210 [2]	NA	120-210	NA	—

[1] Nagler (1985).

[2] Zielbauer (1949).

NA - Not available.

2.4.5 Site Hydrogeology

In 1985 Dames and Moore installed three groundwater monitoring wells on the WDI site. The depth to water in these wells varied from 50.5 to 52.5 feet. These wells would seem to indicate the presence of the Bellflower aquiclude, since the Gage aquifer has not been found with any degree of frequency or thickness in this area and the Artesia aquifer is often found at significantly greater depths in Santa Fe Springs.

In addition to the depth to groundwater, Dames and Moore determined that the direction of groundwater beneath the WDI site is to the southwest (towards Los Nietos Road) and that the groundwater exhibits a shallow gradient of 0.2 percent slope. However, the velocity of groundwater flow is unknown and no information is available on other hydrogeologic characteristics of the aquifer(s) beneath the WDI site.

2.5 PREVIOUS SITE INVESTIGATIONS

As shown on Figures 2-2 and 2-3, the WDI site consists of many individually owned parcels of land. Several of these parcels and the central portion of the site, which contains the reservoir and sumps, have been the focus of previous remedial investigations. The following discussions describe the results of this work.

2.5.1 Campbell Property

The Campbell property is located at the northwest corner of Los Nietos Road and Greenleaf Avenue. This property was used for a variety of purposes including metal plating and fertilizer manufacturing.

Using cone penetrometer testing (CPT), the dimensions of a sump at Campbell property was defined (Dames and Moore 1986a). The total volume of this material was estimated to be between 10,000 and 16,000 cubic yards.

Remedial investigations of soils on the Campbell property conducted by John L. Hunter and Associates in 1987 found concentrations of nickel which exceeded the California total threshold limit concentration (TTLC) or the dry weight (milligram/kilogram) concentration above which contaminants in soil are considered hazardous. Concentrations of chromium, nickel, copper, zinc, arsenic, cadmium and lead were also found in samples which exceeded the soluble threshold limit concentration (STLC), which is the leachable concentration (in milligrams/liter) above which contaminants are considered hazardous. Although the waste extraction test (WET) was not performed on the soil samples, these results indicate that a significant potential exists for the metals to be leached from the soils and transported to the groundwater.

Ebasco Services Inc. (Ebasco) conducted a remedial investigation of the Campbell property from September to December 1988. This included drilling and sampling 14 soil borings to a depth of 35 feet. The soil sample analysis results (Table 2-8) indicate the presence of 12 metals, eight volatiles, four semivolatiles, and one pesticide. Metals are concentrated between the depths of 5 and 10 feet and occur again at 35 feet below ground surface. The concentration of arsenic, barium, copper, lead, nickel, thallium and vanadium exceed the STLC.

One semivolatile (benzo(a)pyrene), and the one pesticide (dieldrin) are present on or near the ground surface. Some of the semivolatiles such as phenanthrene, 2-chlorophenol and a few of the volatiles such as ethylbenzene occur at several depths. The remainder of the contaminants occur at the 35-foot depth. Toluene and methylene chloride (both common laboratory contaminants) were found at several depths.

2.5.2 Toxo Spray Dust Property

According to aerial photos of the WDI site (ASCS 1953) and Department of Health Services records (Dames and Moore 1986b), Toxo Spray Dust Inc. (Toxo) owned and operated a pesticide manufacturing and storage facility north of Los Nietos Road between Greenleaf Avenue and Santa Fe Springs Road for many years beginning in 1953.

TABLE 2-8

CONTAMINANTS FOUND AT CAMPBELL PROPERTY

Contaminant	Depth (in ft)	Concentration	STLC Values[a]	EP Toxicity[a] Limits
Metals (in ppm)				
Aluminum, Al	5-10,35	10500.00 - 28500.00	b	c
Arsenic, As	35	5.5 - 14.9	5.00	5.0
Barium, Ba	10,35	107.00 - 263.00	100.00	100.00
Calcium, Ca	5,35	6300.00 - 25800.00	b	c
Copper, Cu	5-10,35	26.90 - 87.00	25.00	c
Lead, Pb	5-10,35	8.42 - 24.90	5.00	5.0
Magnesium, Mg	5-10,35	9290.00 - 13600.00		b
Nickel, Ni	5-10,35	2170 - 32.60	20.00	c
Sodium, Na	5-10,35	814.00 - 1150.00	b	c
Thallium, Tl	5-10,35	12.10 - 25.10	7.00	c
Vanadium, V	5-10,35	36.70 - 76.10	24.00	c
Molybdenum	0	2.06	250.00	c
Semivolatiles (in ppb)				
Naphthalene	35	1200.00	b	c
Phenanthrene	0,10,35	19.00 - 1000.00	b	c
Benzo(a)pyrene	0-5	55.00 - 960.00	b	c
2-Chlorophenol	5,20	71.00 - 9600.00	b	c
Pesticides (in ppb)				
Dieldrin	5	110.00 - 120.00	0.8	8.0
Volatiles (in ppb)				
Methylene chloride	0,40,50	1.00 - 810.00	b	c
1,1-Dichloroethene	35	2.00 - 3.00	b	c
1,1,1-Trichloroethane	35	7.00 - 9.00	b	c
Tetrachloroethane	35	1200.00	b	c
Toluene	0,10,20,35	1.00 - 420.00	b	c
Ethylbenzene	0,10,20,35	2.00 - 300.00	b	c
Xylene (total)	0,35	4.00 - 31.00	b	c
Benzene	35	1.00 - 6.00	b	c

[a] Neither the waste extraction test (WET) to determine the STLC nor the EP Toxicity test have been conducted on WDI soil samples at this time. These values are provided for reference purposes only. Generally, if the concentration of a metal is 10 times the STLC or EP Toxicity test in soil it can be considered likely to occur in hazardous concentrations in leachate.

[b] Soluble Threshold Limit Concentrations (STLC) values have not been established for these metals and organics under Title 22 of the California Code of Regulations (CCR).

[c] EP Toxicity limits have not been established for these metals and organics under the Code of Federal Regulations (CFR).

On July 1, 1986, Dames and Moore (1986b) collected two samples from the flooring in the former dry-mix area of the Toxo production building. On July 9, 1986, six shallow soil vapor probes were installed. The vapor probes were constructed of 1-inch diameter steel pipe and were 6 feet in length. Vapor concentrations were measured over 15-minute periods with an organic vapor analyzer (OVA), natural gas indicator (NGI), and an HNu Photoionization Detector (HNu). A vapor sample was collected from vapor probe VP-1 for chemical analysis.

In September 1986, the Toxo operations building was demolished. Following the demolition, Dames and Moore collected two soil samples at a depth of 10 inches from directly beneath the former building location.

Floor samples contained methylparathion, ethylparathion, endosulfan I, and endosulfan II. The vapor sample from VP-1 contained 231,000 ppm (23.1 percent by volume in air) of methane and 597 ppm of total nonmethane hydrocarbon as hexane. The soil samples contained malathion, ethylparathion and endosulfan I. Soils also contained concentrations of aldrin, 4,4'-DDE and 4,4'-DDT which exceed the state of California total threshold limit concentration (TTLC) limits for hazardous waste. Based on these results, the California Department of Health Services required that the Toxo Spray Dust building be demolished and disposed of in a Class I landfill for disposal.

Ebasco conducted remedial investigation of the Toxo property from September to December 1988. This work consisted of the drilling and sampling of five soil borings to an average depth of 35 feet. The results of this work (Table 2-9) indicate the presence of 12 metals and 6 volatiles. No pesticides, PCBs or semivolatiles were detected.

2.5.3 Reservoir and Sump Area

During 1984 and 1985, a study conducted by Dames and Moore found levels of barium, cadmium, copper, lead, mercury, nickel, silver, vanadium and zinc in soil samples above the soluble threshold limit concentration (STLC). Dames and Moore also found elevated concentrations of ethylbenzene, tetrachloroethene, toluene, trichloroethene, total xylenes, naphthalene and phenanthrene in subsurface soil samples.

Ebasco conducted a remedial investigation of the WDI reservoir and sumps from September to December 1988. Laboratory results received at the time of this report indicate the following:

- o The concentration of arsenic and lead exceed the TTLC in a few locations and at a few depths on the WDI site. Generally, these correspond to the locations and depths of WDI reservoir and sumps. The concentrations of all other contaminants at all depths and locations are below the TTLC.

- o Aluminum, arsenic, barium, calcium, copper, iron, lead, magnesium, mercury, nickel, potassium and zinc are present in various concentrations in WDI site soils (Table 2-10). The concentration of arsenic, copper, barium and lead are high enough above (10 times) the STLC so as to constitute a potential threat to the quality of groundwater beneath the site and to public health.

- o PCB, pesticide, volatile and semivolatile contamination are present in various concentrations at the WDI site (Tables 2-11, 2-12, and 2-13). These include aroclor, chlordane, vinyl chloride, 1,1,1-trichloroethane, 1,1-dichloroethene, benzene, phenol, 1-chlorophenol, 1,4-dichlorobenzene, and fluorene . The high concentrations of 2-chlorophenol, 1,4-dichlorobenzene, fluorene, benzene, toluene, xylene and ethyl benzene constitute a potential threat to groundwater quality and to public health.

- o Petroleum hydrocarbon contamination is widespread at the site (Table 2-14). The concentrations of this type of contaminant are of concern because they exceed standards which have been established by California state regulatory agencies for the definition of hazardous waste.

TABLE 2-10

METALS CONTAMINATION COMPARED TO BACKGROUND
WDI RESERVOIR/SUMPS

Metals	Background Concentrations (mg/kg)	On-Site [a] Concentrations (mg/kg)	STLC Values (mg/l)	EP Toxicity Limits (mg/l)
Aluminum, Al	3450.00 - 10300.00	6895.00 - 54000.00	b	c
Antimony, Sb	2.70 - 3.00	2.85 - 25.00	15.00	c
Arsenic, As	1.68 - 2.31	2.00 - 337.00	5.00	5.0
Barium, Ba	37.50 - 71.10	54.00 - 3790.00	100.00	100.0
Beryllium, Be	0.196 - 0.278	0.24 - 3.28	0.75	c
Cadmium, Cd	0.255 - 0.363	0.31 - 50.10	1.00	1.0
Calcium, Ca	1360.0 - 1870.0	1615.00 - 56100.00	b	c
Chromium, Cr	5.96 - 12.10	9.03 - 149.00	560.00	5.0
Cobalt, Co	3.00 - 7.17	5.09 - 33.50	80.00	c
Copper, Cu	4.95 - 13.80	9.38 - 721.00	25.00	c
Iron, Fe	6130.00 - 13700.00	9915.00 - 74900.00	b	c
Lead, Pb	3.33 - 7.00	5.17 - 2790.00	5.00	5.0
Magnesium, Mg	1660.00 - 3220.00	2440.00 - 20500.00	b	c
Manganese, Mn	88.80 - 263.00	175.90 - 2270.00	b	c
Mercury, Hg	0.018 - 0.0137	0.08 - 10.90	0.20	0.2
Molybdenum, Mo	0.194 - 0.268	0.23 - 33.40	350.00	c
Nickel, Ni	4.05 - 9.23	6.64 - 105.00	20.00	c
Potassium, K	818.00 - 2260.00	1539.00 - 13200.00	b	c
Selenium, Se	0.202 - 0.278	0.24 - 1.07	1.00	1.0
Silver, Ag	0.863 - 0.939	0.90 - 4.80	5.00	5.0
Sodium, Na	123.00 - 231.00	177.00 - 6650.00	b	c
Thallium, Tl	9.77 - 12.00	10.90 - 99.10	7.00	c
Vanadium, V	10.60 - 27.30	18.95 - 180.00	24.00	c
Zinc, Zn	22.10 - 38.30	30.20 - 775.00	250.00	c

[a] Neither the waste extraction test (WET) to determine the STLC nor the EP Toxicity test have been conducted on WDI soil samples at this time. These values are provided for reference purposes only. Generally, if the concentration of a metal is 10 times the STLC or EP Toxicity test in soil it can be considered likely to occur in hazardous concentrations in leachate.

[b] Soluble Threshold Limit Concentrations (STLC) values have not been established for these metals under Title 22 of the California Code of Regulations (CCR).

[c] EP Toxicity limits have not been established for these metals under Section 40 the Code of Federal Regulations (CFR).

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TABLE 2-11

PESTICIDES/PCBS CONTAMINATION
WDI RESERVOIR/SUMPS

Depth (ft)	Compound	STLC Values (mg/l)	Concentration (ug/kg)
0	Beta - BHC	a	11.0 [b]
0	Heptachlor Epoxide	a	2.5 - 46.0
0	Alpha-Chlordane	0.25	1.3 - 210.0
5	Aroclor - 1242	a	80.0 [b]
15	Aroclor - 1221	a	91.0 [b]
20	Heptachlor	0.87	87.0 [b]
40	Alpha - BHC	a	1.0 [b]
0, 10	Dieldrin	0.8	2.8 - 35.0
0, 10	Aroclor - 1248	5.0	45.0 - 1,700.0
0, 20	Gamma-Chlordane	a	0.1 - 270.0
5, 20	Endrin	0.02	1.3 - 14.0
10, 35	Gamma - BHC (Lindane)	0.4	7.0 - 15.0
0-10	4,4'-DDT	a	6.5 - 160.0
0-15	4,4'-DDD	0.1	9.1 - 90.0
0-20	4,4'-DDE	a	6.3 - 11.0
0-20, 35	Aroclor - 1260	a	100.0 - 1300.0
10-20, 35	Aroclor - 1254	a	86.0 - 570.0

[a] STLC Values have not been established for these chemicals under Title 22 of the California Code of Regulations (CCR).

[b] This represents a single "hit" at a single depth. No other concentration was detected for this or any other depth. Therefore, a range of concentrations is not available.

TABLE 2-12

VOLATILE ORGANIC COMPOUNDS (VOC) CONTAMINATION
WDI RESERVOIR/SUMPS

Depth (ft)	Compound	STLC Values (mg/l)	Concentration (ug/kg)
5	Chloromethane	a	2.0 [d]
10	Carbon Tetrachloride	a	2.0 [d]
10	Styrene	a	1.0 [d]
20	Chlorobenzene	a	70.0 [d]
10-15	Vinyl Chloride	a	1.0 - 420.0
0-10	2-Hexanone	a	3.0 - 17,000.0
5-15	Carbon Disulfide	a	1.0 - 10.0
0-10, 20	4-Methyl-2-Pentanone	a	1.0 -5,400.0
0, 40-45	Vinyl Acetate	a	9.0 - 76.0
0, 10-18	1,2-Dichloroethene (total)	a	1.7 - 22.0
5-10, 20, 35	1,1-Dichloroethene	a	2.0 - 1,200.0
10-20, 35	Trichloroethene [c]	204	1.0 - 550.0
5-35	1,1,1-Trichloroethane	a	3.0 - 23,000.0
0-35	Benzene [c]	a	0.2 - 12,000.0
0-20, 30-35, 45	Tetrachloroethene	a	1.0 - 5,200.0
0-35, 50	Ethylbenzene [c]	a	1.0 - 73,000.0
0-35, 60	Xylene [c]	a	2.0 - 410,000.0
0-50	2-Butanone	a	1.0 - 1,200.0
0-60	Methylene Chloride [b]	a	1.0 - 4,200.0
0-60	Acetone [b]	a	1.0 - 7,600.0
0-60	Toluene [b,c]	a	0.8 - 44,000.0

[a] STLC Values have not been established for these chemicals under Title 22 of the California Code of Regulations (CCR).

[b] Common laboratory contaminant.

[c] Constituents commonly found in total petroleum hydrocarbon.

[d] This represents a single "hit" at a single depth. No other concentration was detected at this or any other depth. Therefore, a range of concentrations is not available.

TABLE 2-13

HIGHEST CONCENTRATION OF SEMIVOLATILE ORGANIC COMPOUNDS
WDI RESERVOIR/SUMPS

Location	Sample Number	Depth (ft)	Compound	STLC Values (mg/l)	Concentration (ug/kg)
SB-016-005	WD 161	5	4-Chloroaniline	a	140.0
SB-017-011	YD 868	35	Pentachlorophenol	a	340.0
SB-024-005	YF 151	10	Pyrene	a	4,200.0
" "	" "	"	Benzo(b)fluoranthene	a	2,200.0
" "	" "	"	Indeno(1,2,3-cd)pyrene	a	450.0
" "	" "	"	Benzo(g,h,i)perylene	a	660.0
SB-038-007	WD 017	5	Phenanthrene	a	31,000.0
SB-038-016	WD 043	0	Fluoranthene	a	3,800.0
" "	" "	"	Benzo(a)pyrene	a	1,700.0
" "	" "	"	Acenaphthene	a	4,100.0
" "	" "	"	4-Nitrophenol	a	5,000.0
SB-039-004	WD 019	5	1,2-Dichlorobenzene	a	1,600.0
SB-039-010	WD 070	0	Benzo(k)fluoranthene	a	440.0
" "	" "	"	2,6-Dinitrotoluene	a	3,500.0
SB-041-010	YD 816	20	Anthracene	a	16,000.0
" "	" "	"	Benzo(a)anthracene	a	1,500.0
SB-041-013	YD 817	25	Chrysene	a	8,000.0
" "	" "	"	Fluorene	a	18,000.0
SB-047-008	WD 078	15	Naphthalene	a	48,000.0
" "	" "	"	2-Methylnapthalene	a	120,000.0
" "	" "	"	Dibenzofuran	a	1,300.0
SB-048-012	WD 083	15	4-Methylphenol	a	1,200.0
" "	" "	"	Isophorone	a	3,200.0
SB-050-004	YD 858	10	2,4-Dinitrotoluene	a	130.0

TABLE 2-13

HIGHEST CONCENTRATION OF SEMIVOLATILE ORGANIC COMPOUNDS
WDI RESERVOIR/SUMPS
(Continued)

Location	Sample Number	Depth (ft)	Compound	STLC Values (mg/l)	Concentration (ug/kg)
SB-061-001	YD 188	0	2-Methylphenol	a	79.0
SB-069-015	YD 480	20	Phenol	a	4,800.0
" "	" "	"	2-Chlorophenol	a	5,200.0
" "	" "	"	1,4-Dichlorobenzene	a	2,400.0
" "	" "	"	N-Nitroso-di-n-propylamine	a	2,700.0
" "	" "	"	1,2,4-Trichlorobenzene	a	2,600.0
" "	" "	"	4-Chloro-3-Methylphenol	a	5,300.0
SB-069-019	WD 081	35	N-Nitrosodiphenylamine	a	4,000.0
SB-079-001	YD 798	0	Butylbenzylphthalate [b]	a	26,000.0
" "	" "	"	Bis(2-Ethylhexyl) phthalate [b]	a	280,000.0
" "	" "	"	Di-n-octylphthalate [b]	a	140,000.0
" "	" "	"	Dimethylphthalate [b]	a	1,000.0
SB-085-011	YF 164	15	Diethylphthalate [b]	a	48.0
SB-088-003	YF 170	5	4-Nitroaniline	a	82.0
SB-107-006	YE 849	15	Hexachloroethane	a	280.0
TP-003-004	WD 110	0	Di-n-butylphthalate [b]	a	2,200.0
TP-003-005	WD 114	0	Dibenz(a,h)anthracene	a	160.0
TP-006-001	WD 127	0	2-Nitrophenol	a	9,000.0
TP-006-003	WD 121	0	Benzoic Acid	a	4,500.0

[a] STLC values have not been established for these chemicals under Title 22 of the California Code of Regulations (CCR).

[b] Common laboratory contaminant.

TABLE 2-14

TOTAL PETROLEUM HYDROCARBONS
WDI RESERVOIR/SUMPS *

Sample ID	Concentration (mg/kg)
SB-018-1.5	345
SB-018-015	6106
SB-018-020	1184
SB-019-015	492
SB-019-015	334
SB-019-20	369
SB-019-035	350
SB-020-35	750
SB-026-04	1356
SB-026-08	248
SB-026-12	181
SB-026-16	178
SB-026-20	199
SB-033-5	7798
SB-033-10	285
SB-033-15	482
SB-033-20	449
SB-033-35	0
SB-037-1.5	543
SB-053-1	1887
SB-053-5	317
SB-053-10	275
SB-053-15	236
SB-053-20	618
SB-053-25	248
SB-055-5	150
SB-055-15	14851
SB-055-20	8721
SB-055-35	344
SB-055-35	2736
SB-056-10	292
SB-056-20	275
SB-056-25	498
SB-056-35	299
SB-056-30	315
SB-056-0	4085
SB-055-10	1146
SB-067	650

* TPH values are obtained using field instruments. These do not represent the entire site. The soils and sludges found in the sumps and reservoir have not been analyzed for TPH, however, from visual observations indicate 3 to 4 percent TPH.

3.0 REMEDIAL INVESTIGATION METHODS

Field investigations at WDI were designed to determine the nature and extent of groundwater contamination at this site. The major components of the groundwater characterization program are as follows:

- o Design and install twenty seven (27) groundwater monitoring wells;
- o Measure water levels; collect groundwater samples;
- o Analyze groundwater samples in the laboratory;
- o Use water level measurements to identify groundwater gradient and direction of flow; and
- o Evaluate laboratory results to characterize the extent of groundwater contamination.

The following sections describe the specific methodologies for this work in more detail.

3.1 DESIGN AND INSTALLATION - GROUNDWATER MONITORING WELLS

3.1.1 Well Locations

Of the one hundred (100) soil borings that were drilled during WDI remedial investigation activities, twenty seven (27) borings were drilled using a 10-inch auger and were converted into groundwater monitoring wells (Figure 3-1, Table 3-1). Figure 3-2 shows the relative positions of the monitoring wells with respect to the site's surface topography. The results of soil samples collected for chemical analysis during drilling of the wells are summarized in Section 2.0.

Figure 3-1
GROUNDWATER MONITORING
WELL LOCATIONS
WASTE DISPOSAL INC.

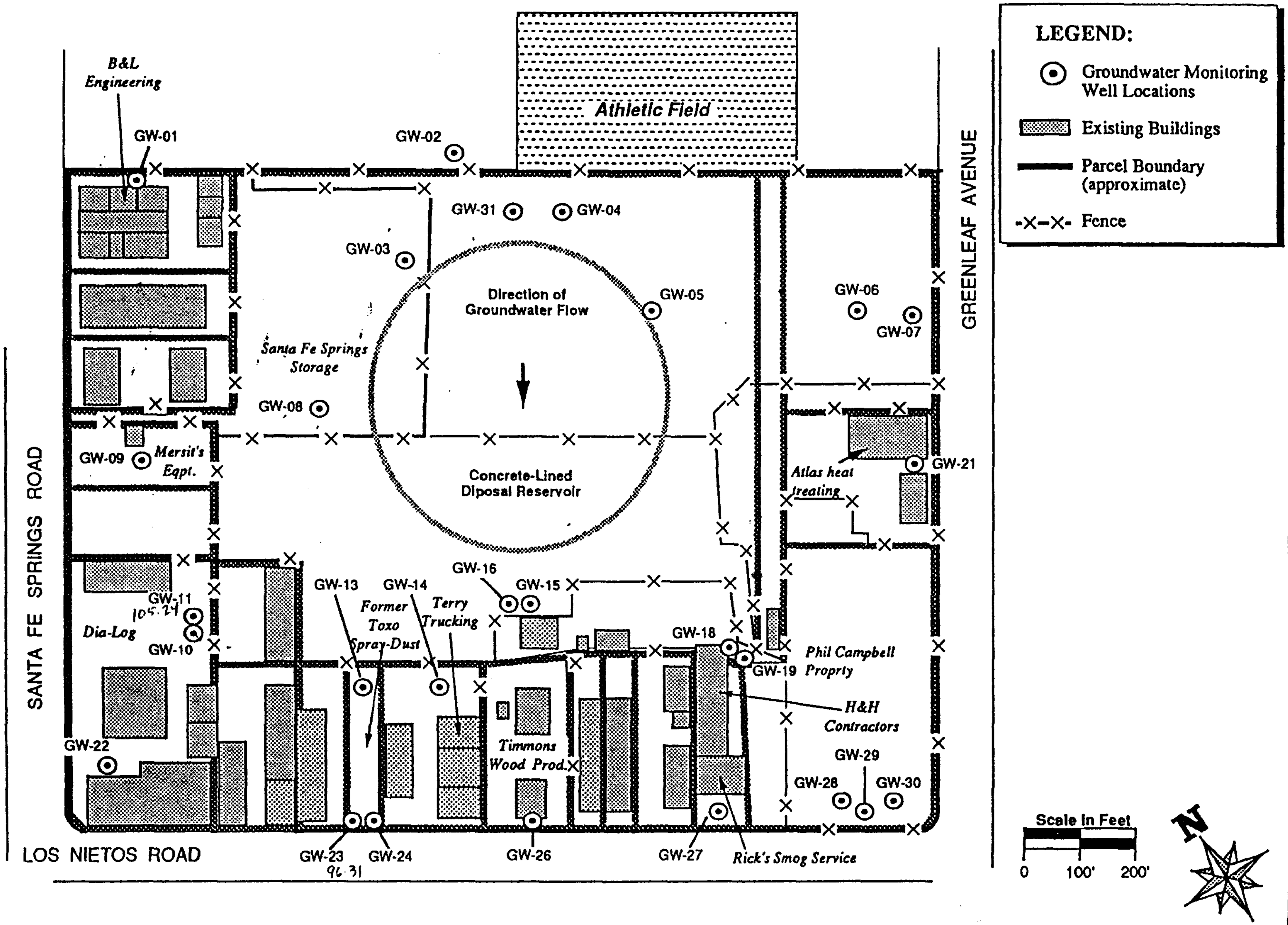

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TABLE 3-1

GROUNDWATER MONITORING WELL LOCATIONS AND DESIGN SPECIFICATIONS

Location	GW Well Number	Soil Boring Number	Boring Depth (feet)	Well Depth (feet)	Screen Length (feet)	Imp. Seal Thickness (feet)	Depth to Groundwater (feet)	Surface Elevation (feet above msl)	Well Type	Date
B&L Engineer	GW-02	SB-005	55	53	20	4.5	41	153.76	Shallow	9/15/88
Fedco Dist. Center	GW-01	SB-008	60	58	20	4.5	48	149.61	Shallow	9/16/88
RV Storage	GW-03	SB-026	70	68	20	4.5	63	167.76	Shallow	10/19/88
Reservoir	GW-04	SB-017	70	68	20	4.5	58	167.01	Shallow	9/26/88
Reservoir	GW-05	SB-036	65	63	20	4.5	59	166.92	Shallow	10/03/88
Reservoir	GW-06	SB-029	66.5	63	20	4.5	50	158.63	Shallow	9/13/88
Reservoir	GW-07	SB-030	60	58	20	4.5	49	154.78	Shallow	9/14/88
RV Storage	GW-08	SB-046	65	63	20	4.5	57	163.63	Shallow	10/19/99
Mersit's Equipment	GW-09	SB-054	60	58	20	4.5	50	153.77	Shallow	10/13/99
Dia-Log	GW-10	SB-073	130	128	10	4.5	49	154.98	Intermediate	9/29/88
Dia-Log	GW-11	SB-072	60	58	20	4.5	49	154.91	Shallow	9/25/88
Toxo Spray Dust	GW-13	SB-075	60	59	20	4.5	53	157.77	Shallow	10/07/88
Terry Trucking	GW-14	SB-076	60	58	20	4.5	52	157.92	Shallow	10/18/88
Reservoir	GW-15	SB-103	70	68	20	3.0	57	163.55	Shallow	10/12/88
Reservoir	GW-16	SB-101	79	79	5	4.5	55	163.32	Intermediate	10/17/88
H&H Contractors	GW-18	SB-104	74	74	5	4.5	54	159.34	Intermediate	10/14/88
H&H Contractors	GW-19	SB-105	60	58.5	20	4.5	54	159.16	Shallow	10/14/88
Atlas Heat Treating	GW-21	SB-062	60	65	20	4.5	48	155.49	Shallow	10/01/88
Dia-Log	GW-22	SB-092	80	78	20	4.5	68	156.94	Shallow	9/23/88
Toxo Spray Dust	GW-23	SB-093	65	63	20	4.5	58	157.23	Shallow	10/04/88
Toxo Spray Dust	GW-24	SB-094	115	113	10	4.5	58	157.03	Intermediate	10/05/88
Timmons Wood	GW-26	SB-096	66.5	63.5	20	4.5	53	156.29	Shallow	9/20/88
Rick's Smog Service	GW-27	SB-097	66.5	63	20	4.5	49.5	157.28	Shallow	9/22/88
Campbell Property	GW-28	SB-098	66.5	63.5	20	4.5	49.5	157.56	Shallow	9/19/88
Campbell Property	GW-29	SB-099	65	64	20	4.5	49.5	157.69	Intermediate	10/06/88
Campbell Property	GW-30	SB-100	96	93.5	20	4.0	86	157.01	Deep	10/26/88
Reservoir	GW-31	SB-016	65	63	20	4.5	58	167.47	Shallow	10/03/88

Note: The deep wells, GW-12, GW-17, GW-20 and GW-25, were not drilled because deep penetration of groundwater contamination was not expected.

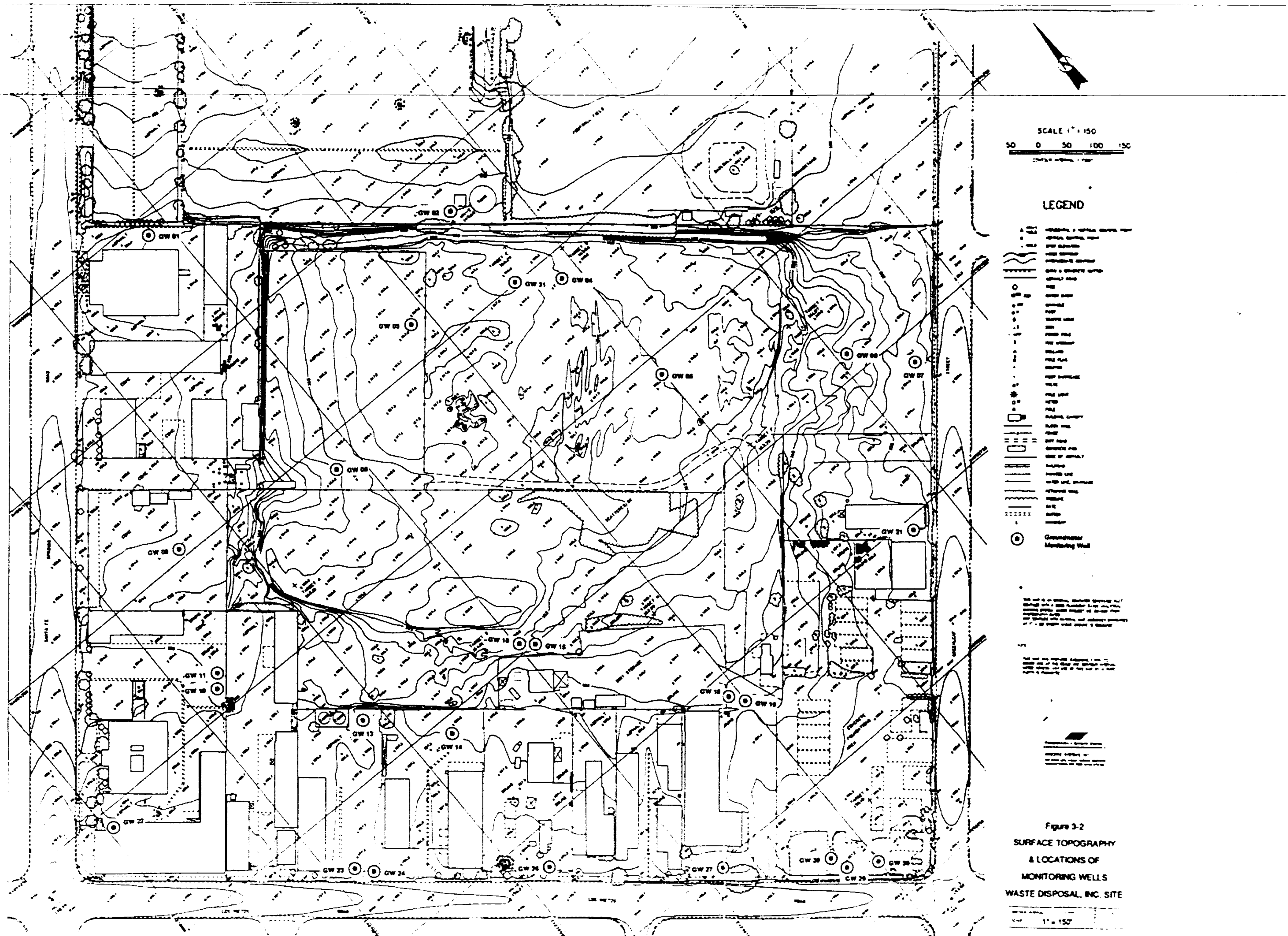

Figure 3-2
SURFACE TOPOGRAPHY
& LOCATIONS OF
MONITORING WELLS
WASTE DISPOSAL, INC. SITE

1" = 150'

Six wells including GW-01, GW-02, GW-07, GW-22, GW-26 and GW-29 were the first to be installed at the WDI site. These wells were located around the site perimeter and were used to determine the local groundwater gradient and direction of flow. Once this information was determined the remaining twenty one (21) wells were installed downgradient of known sources of contamination. The deep wells, GW-12, GW-17, GW-20 and GW-25, proposed in the FSAP, were not installed because sampling of wells done prior to this time during Phase I field investigations indicated that deep penetration of groundwater contamination may not have occurred.

3.1.2 Well Design and Construction

The design and construction of the monitoring wells were in accordance with the general guidelines for monitoring well installation as described in the WDI Field Sampling and Analysis Plan, Revision 2, Section 4.2.2 (Ebasco 1988) and REM III Field Technical Guideline FT-7.01.

Of the 27 groundwater monitoring wells installed, twenty one (21) were shallow wells designed to sample the uppermost aquifer. These wells were completed at the water table at a depth of approximately 55-70 feet (Figure 3-3). This allowed for a 20-foot screen, with approximately 10 feet above the saturated zone and 10 feet below. The purpose of this design was to allow for the sampling of any possible free-floating contaminants on top of the water table, as well as dissolved-phase contaminants below the water table and to obtain groundwater elevation and flow information.

Four double-well clusters were installed. Each double-well cluster consisted of a shallow well and an intermediate well (Figure 3-4). The shallow wells were constructed similar to the other wells on the site to the approximate depth of 60-70 feet. The intermediate wells were completed immediately above the first clay layer below the water table. The depth of the intermediate wells range from 74-130 feet.

One triple well cluster was installed. The triple-well cluster included a shallow well, an intermediate well and a deep well (Figure 3-5). The shallow well was installed 65 feet below ground surface and was similar in

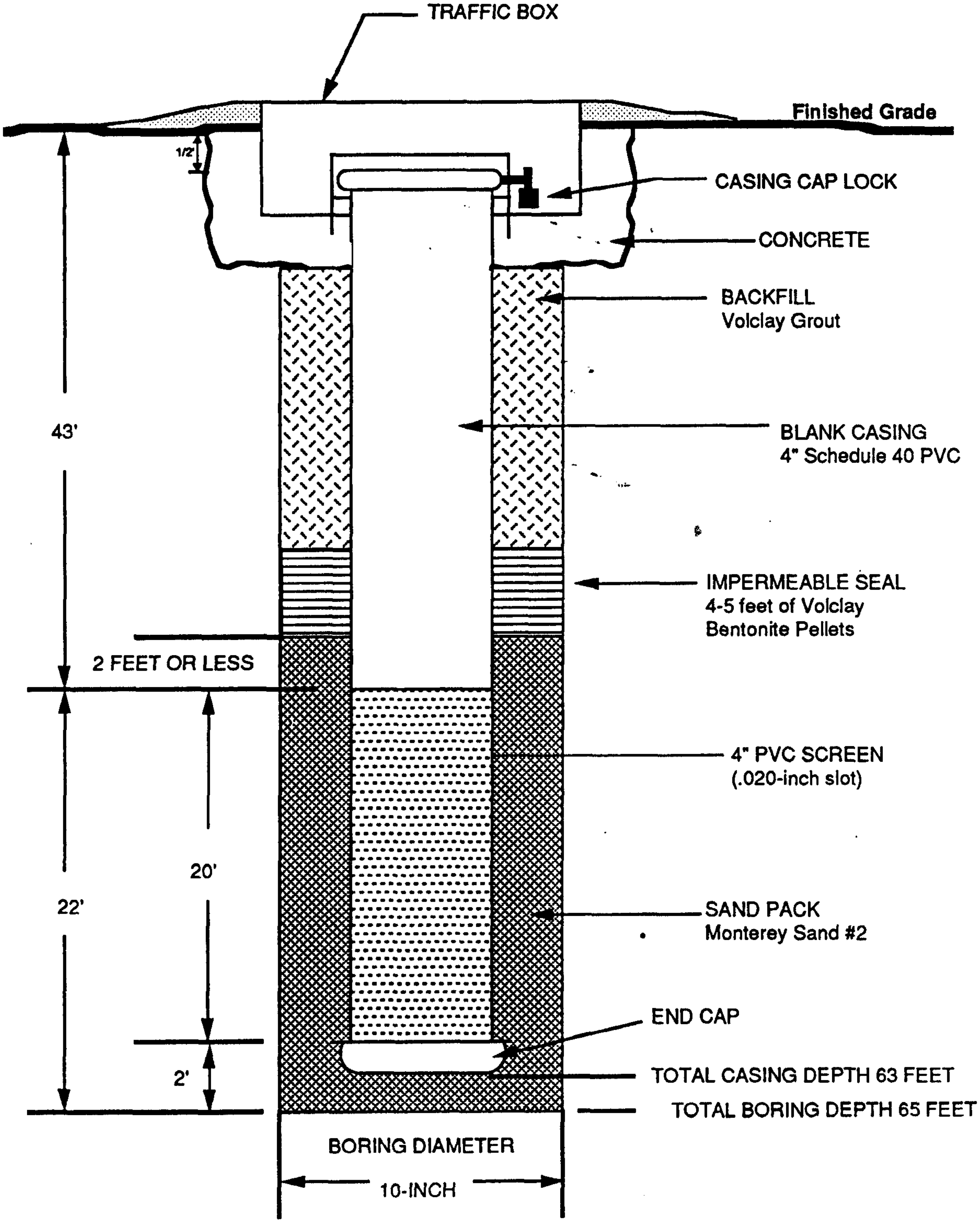

Figure 3-3

Design of Typical Groundwater Monitoring Well Assumed Boring Depth 65 Feet Waste Disposal Inc.

E#23-W

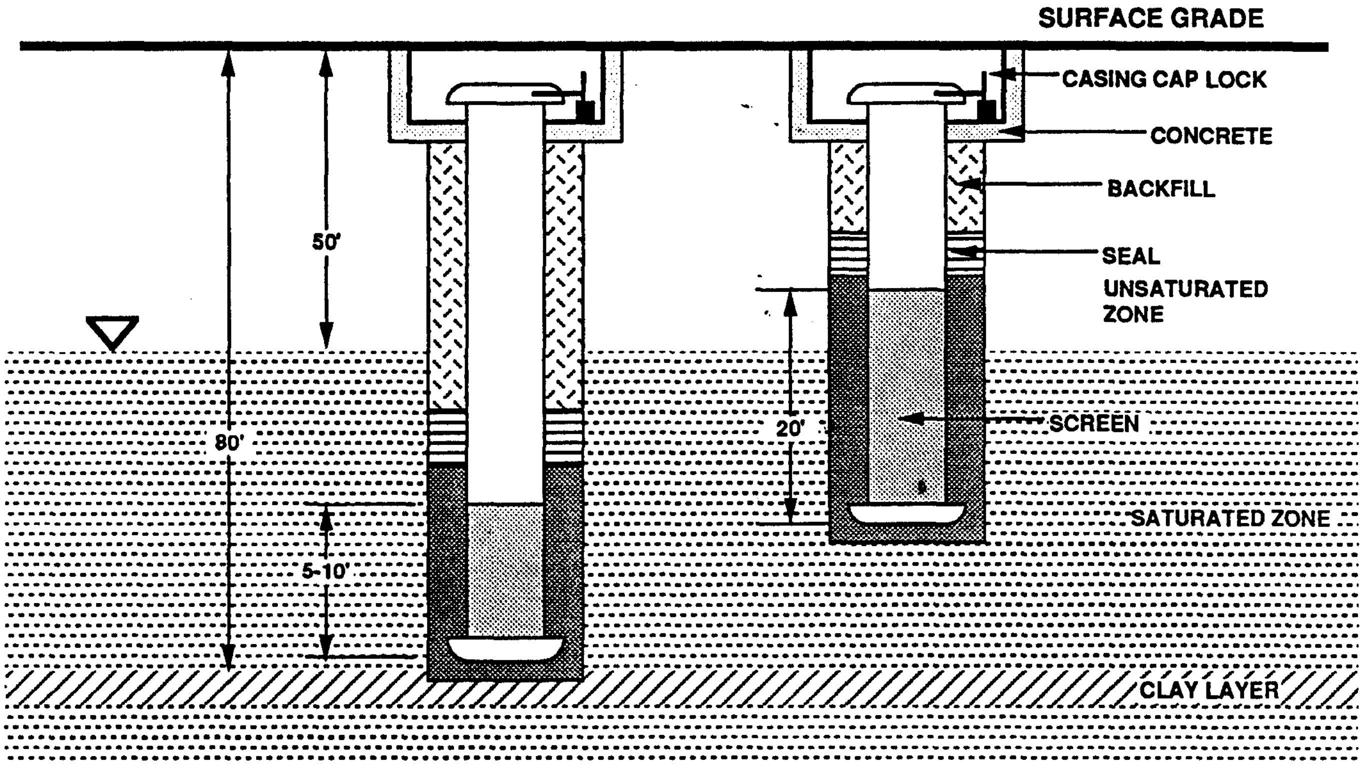

Figure 3-4

DESIGN OF TYPICAL DUAL WELL CLUSTERS WASTE DISPOSAL INC.

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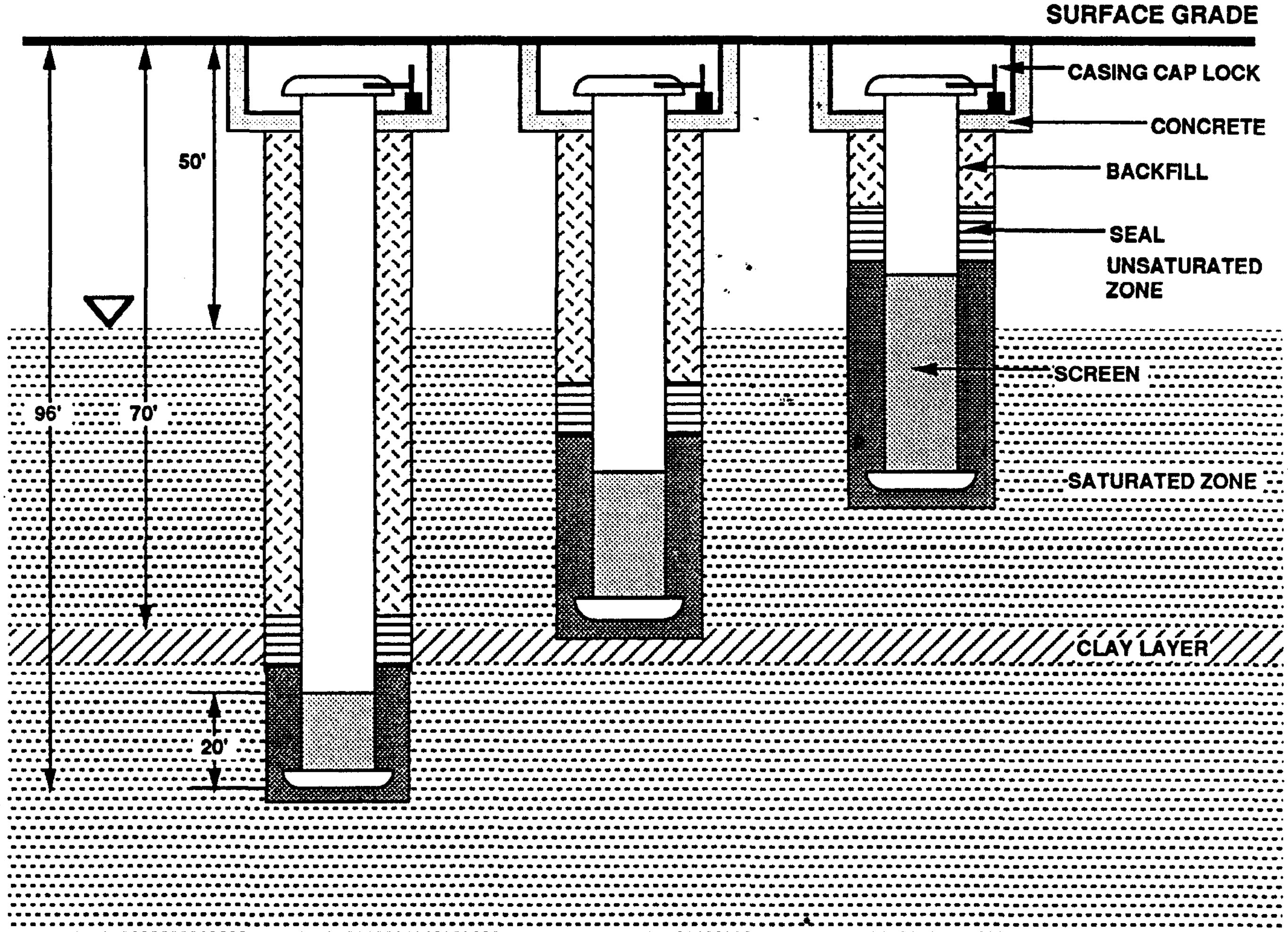

Figure 3-5

DESIGN OF TYPICAL TRIPLE-WELL CLUSTERS WASTE DISPOSAL INC.

E#23-W

construction to other shallow wells on the site. The intermediate well was completed immediately above the first clay layer below the water table (approximate depth 70 feet). The deep well penetrated this clay layer and was completed immediately below it.

In general, the intermediate well was designed to sample denser contaminants such as halogenated hydrocarbons which may have sunk to the top of the first clay layer. The deep well was designed to sample dissolved-phase contaminants beneath this clay layer. All wells in double- and triple-well clusters were installed in separate borings. All PVC well casings were steam cleaned and rinsed with deionized water prior to installation in the boreholes.

The installation of shallow and intermediate monitoring wells was conducted in accordance with the following general procedure:

- Well depths were set by the rig geologist based on the stratigraphic log developed from the analysis of samples taken at 5-foot intervals and also the location of the water table at the particular boring.

- Soil samples from at least three different depths above the water table were kept for chemical analysis.

- The well was advanced to the chosen depth with a 10-inch O.D. (outside diameter) hollow-stem auger.

- Blank casing was flush threaded to 20 feet of .020-slot PVC screen. This screen and casing was set at the bottom of the borehole through the middle of the hollow-stem auger. The screen bottom was plugged.

- Auger flights were removed from the borehole one section at a time to keep the formation from caving.

- The annular space between the PVC and boring wall was backfilled from the bottom of the well to at least 2 feet above the top of the PVC screen with Monterey No. 2 sand. A 4- to 5-foot volclay bentonite seal was placed on the sand, and the remaining annular space was backfilled with volclay grout mixture.

- o Blank casing above the land surface was sawed and filed to fit within a traffic box flush with the existing grade.

- o A casing cap, a protective locking cover, and a traffic box were installed for each well.

- o A 3- to 4-foot-diameter cement pad was created around the traffic box and sloped in such a way as to direct surface runoff away from the casing.

The procedure followed in installation of the deepest well of the triple-well cluster was as follows:

- o The well was drilled with an air rotary rig until a layer of clay or low permeability silt and clay was identified (approximate depth 96 feet). A 10-inch O.D. steel conductor casing was driven down the borehole to keep the formations from caving. The casing was pushed into the clay layer. The annular space was filled with grout mixture and allowed to set. The interior of the casing was filled with grout and allowed to set. A smaller diameter (8-inch O.D.) conductor casing was driven through the bottom of the first casing until the desired depth was reached. A 4-inch O.D. PVC casing with 20 feet of .020-slot screen was set inside the 8-inch O.D. conductor casing.

- o The annular space between the PVC and conductor casing was backfilled from the bottom of the well to at least 2 1/2 feet above the top of the PVC screen with graded, clean Monterey No. 2 sand. A 4-foot bentonite seal was placed on the sand, and the remaining annular space was backfilled with volclay grout mixture to approximately 7 feet below ground surface. All conductor casing was removed from the ground prior to pouring the grout.

- o Blank casing above the land surface was sawed and capped.

A complete set of well installation reports is included in Appendix A.

3.2 GROUNDWATER SAMPLING PROCEDURES

3.2.1 Well Development

The monitoring wells were developed after construction to clear the well screen and sandpack of fine materials that could possibly clog the screen slots reducing the effectiveness of the well screen. All monitoring wells were developed by bailing, surging and pumping in accordance with REM III Field Technical Guideline FT-7.01. A summary of information regarding well development operations performed at different wells is provided in Table 3-2. Note that the pH, temperature and electrical conductivity values in this table represent the measured values of these parameters at completion of well development operation.

First, an Organic Vapor Analyzer (OVA) was used to determine if high concentration of volatile organic vapors were present in the well. OVA probe was held inside the well within the top three feet. If the OVA reported a reading greater than 5 ppm, a full-face respirator was used during the well development operation.

Second, a water level sounder was used to measure the depth to groundwater. This was done by lowering the measuring tape with the attached probe down the hole. A sounding device and the red light located above ground on the water level reel were activated upon contact of the probe with water in the well.

Third, hydrocarbon indicator paste was placed on the measuring tape. The tape was lowered below the top of the water table to detect any free-floating contaminants. The paste will turn from a pink to a yellow color upon contact with hydrocarbon products.

Fourth, a sample of groundwater was taken from the top of the groundwater with a clear translucent teflon bailer for visual detection of any possible free hydrocarbon. The clear bailer was 1.625 inches in diameter and 2 feet long.

TABLE 3-2

GROUNDWATER MONITORING WELL DEVELOPMENT

Well No.	Depth to GW (feet)	Water Removed by Bailing (gallons)	Water Removed by Pumping (gallons)	Total Water Removed (gallons)	Pumping Rate (gpm)	pH	Temperature (°C)	Electrical Conductivity (uMHOS/cm)	Date
GW-01	46.9	150	90	240	2.0-8.0	7.3	21.7	2,200	11/02/88
GW-02	42.2	150	90	240	2.0-8.0	7.2	21.8	1,740	11/03/88
GW-03	61.1	45	135	180	7.0	7.2	21.2	1,660	10/22/88
GW-04	59.5	250	50	300	2.0-8.0	7.1	20.3	1,940	10/27/88
GW-05	59.8	NA	NA	120	NA	7.0	20.9	2,050	10/28/88
GW-06	51.7	120	120	240	2.0-7.0	7.1	22.1	1,910	10/28/88
GW-07	48.1	180	90	270	NA	7.1	21.6	1,700	10/29/88
GW-08	59.3	45	75	120	2.0-7.0	6.9	22.8	1,780	10/20/88
GW-09	47.5	120	120	240	2.0-8.0	6.9	20.9	1,930	11/01/88
GW-10	49.3	30	54	84	4.0	NA	21.5	1,900	10/03/88
GW-11	49.9	45	207	252	7.0	NA	25.0	1,900	10/03/88
GW-13	51.7	NA	NA	240	2.0-8.0	7.0	21.1	1,800	11/01/88
GW-14	51.8	150	90	240	2.0-8.0	6.9	21.4	1,800	11/01/88
GW-15	57.2	40	80	120	7.0	7.2	20.0	1,700	10/20/88
GW-16	57.3	45	105	150	7.0	7.2	22.5	1,800	10/20/88
GW-18	55.6	40	44	84	7.0	7.2	21.0	1,850	10/17/88
GW-19	54.5	8	76	84	7.0	6.9	24.5	1,950	10/17/88
GW-21	49.7	150	90	240	2.0-8.0	7.1	23.2	2,000	10/29/88
GW-22	64.9	30	54	84	7.0	NA	22.5	1,770	10/03/88
GW-23	59.4	20	-	20	-	6.7	23.7	2,010	10/31/88
GW-24	64.4	120	240	360	2.0-8.0	7.2	23.0	2,070	10/31/88
GW-26	51.4	35	49	84	7.0	NA	24.9	1,850	10/02/88
GW-27	51.8	40	86	126	7.0	NA	22.0	1,800	10/02/88
GW-28	53.80	NA	NA	55	NA	NA	21.5	1,820	10/02/88
GW-29	52.4	150	90	240	2.0-8.0	7.0	22.0	1,920	10/29/88
GW-30	55.4	NA	NA	550	8.0	7.3	21.0	1,460	11/15/88
GW-31	60.0	NA	NA	180	NA	7.2	19.6	1,740	10/27/88

Note: N/A = Data was not available due to measurement equipment failure, etc.

3682E

Fifth, a 15-foot 3.50-inch bottom-filling steel bailer operating on the back of a development truck was used to remove stagnant water and large soil particles and sediments from the wells. After the removal of approximately 10 gallons of water with this bailer, a surge block consisting of a 3.50-inch block installed at the bottom of a galvanized pipe was used to agitate the water in the well causing it to move in and out of the well and the surrounding formation.

This operation helped to stabilize the formation materials near the screen sections. The bailer was used again to remove the well water. The surging and bailing operation was repeated 2-3 times until water in the well was relatively free of large sediment particles. The total volume of water removed at the end of this stage of operation was approximately 50-100 gallons.

Sixth, a stainless steel submersible pump was lowered into the well and the pumping continued until at least three to five casing volumes were removed or until the water appeared to be clear. The pump was less than 3 inches in diameter, 40 inches long with discharge rate of up to 15 gallons per minute.

During well development, samples of groundwater were taken periodically and measured for turbidity, pH, temperature and electrical conductivity. The stabilization of these parameters was another criterion used to determine the completion of well development. If the well did not produce sufficient water, a stainless steel bailer was used instead of the pump for removal of water.

3.2.2 Water Level Measurements

Groundwater elevations were measured at all monitoring wells with the use of an electric water level sounder (at least 24 hours after completion of well development). The water sensor probe attached to the measuring tape was lowered into the well. A sounding device and a red light located on the reel was activated upon the probe's contact with water.

Measurements were made to the top of the PVC well casing within ±0.01 foot level of accuracy. For consistency and accuracy of subsequent measurements, the side of the casing which was used to measure the depth-to-water was marked.

Depth-to-water measurements were converted to elevation-of-water-table values after the elevation of the ground surface, the tops of traffic boxes and the tops of well casings were surveyed. Water level elevation was used to determine the gradient and direction of groundwater flow.

3.2.3 Water Sampling

Groundwater sampling methods and documentation were conducted in accordance with REM III Field Technical Guideline FT-7.02 as described in Section 6.1.3 of the WDI FSAP Revision 2 (Ebasco 1988). The typical procedures involved in collecting water samples from each monitoring well are as follows:

- o Use two bailers per well per day. Decontaminate all bailers at the beginning of each day and collect a sample of final deionized rinsate;
- o Use an OVA to detect volatile organics and determine if a full-face respirator was required;
- o Measure depth to groundwater and check for free-floating hydrocarbons;
- o Purge wells by removing 3-5 well volumes.
- o Monitor temperature, pH, turbidity and electrical conductivity before and after purging and also before and after sampling;
- o Collect a set of groundwater samples for volatile organics, semivolatile organics, pesticides/PCBs, and metals and collect a set of duplicate or QA/QC samples if required; and

- o Label all samples put in cooler with blue ice and bubble wrap and ship to the lab with a chain-of-custody and traffic report.

Three wells per day were sampled. In accordance with EPA's policy, no samples were filtered. Samples from each well were collected with a set of two 3-foot stainless steel bailers. The two bailers were, respectively, 1.625 and 2.375 inches in diameter. Three sets of two bailers were decontaminated and available in each day for sampling. The 1.625 bailer was used to collect the samples for volatile organics. This bailer was lowered into the well slowly to avoid any sudden impact that could cause the release of organic vapors. Once the bailer was filled with water, it was pulled out of the well. A clean teflon bottom-emptying valve was installed at the bottom of bailer and then water from the bailer was poured through this valve into two 40 ml glass vials. Care was taken to ensure sample vials were free of air bubbles.

The remaining samples for semivolatile organics, pesticides/PCB's and metals were collected with a 2.375-inch bailer. The bailer was used as described above to collect water from the well. The water was poured from the bailer into four 1-liter amber glass bottles for semivolatile organics and pesticides/PCB's and into a 1-liter polyethylene bottle for metals. Each sample was filled with water from the same bailer to preserve the integrity of samples. In total, five 1-liter samples were collected from each well, two samples for semivolatile organics, two samples for pesticides/PCB's and one sample for metals.

3.3 ANALYTICAL METHODS

Groundwater samples collected from on-site wells for CLP analysis are as follows:

- o Twenty seven (27) sets of samples were collected for TCL organic and inorganic analysis. This number corresponds to collection of one set of samples from each of 27 monitoring wells;

- o Eight (8) sets of samples were collected as equipment blanks. As indicated before, one set of equipment blank samples was collected in each sampling day.

- o Two (2) sets of samples were collected from GW-09 and GW-19 as duplicates; and

- o Two (2) sets of samples were collected from GW-22 and GW-28 as lab QC samples.

Groundwater samples collected from off-site wells include:

- o Two (2) sets of samples were collected from two off-site wells, OS-01 and OS-04 for TCL organic and inorganic analysis. These wells were located approximately one mile to the northeast and to the northwest directions from the site.

- o One set of samples was collected from OS-01 as duplicates; and

- o One set of samples was collected from OS-04 as lab QC samples.

The samples were analyzed for the complete Target Compound List (TCL) as indicated in Table 3-3. The analysis of the TCL was a Routine Analytical Service (RAS). The RAS methods and quantification limits were specified by the CLP for the TCL parameters. The sample-by-sample CLP request for analyses is shown in Table 3-4.

TABLE 3-3

TARGET COMPOUND LIST - ROUTINE ANALYTICAL SERVICES
VOLATILES

Compounds
Chloromethane
Bromomethane
Vinyl chloride
Chloroethane
Methylene chloride
Acetone
Carbon disulfide
1,1-Dichloroethene
1,1-Dichloroethane
Dichloroethene (Total)
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon tetrachloride
Vinyl acetate
Bromodichloromethane
1,1,2,2-Tetrachloroethane
1,2-Dichloropropane
trans-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
cis-1,3-Dichloropropene
Bromoform
2-Hexanone
4-Methyl-2-pentanone
Tetrachloroethene
Toluene
Chlorobenzene
Ethyl benzene
Styrene
Total xylenes

TABLE 3-3 (Continued)

TARGET COMPOUND LIST - ROUTINE ANALYTICAL SERVICES

SEMI-VOLATILES

Compounds	
N-Nitrosodimethylamine	2,4-Dinitrophenol
Phenol	4-Dinitrophenol
bis(2-Chloroethyl) ether	Dibenzofuran
2-Chlorophenol	2,4-Dinitrotoluene
1,3-Dichlorobenzene	2,6-Dinitrotoluene
1,4-Dichlorobenzene	Diethyl phthalate
Benzyl alcohol	4-Chlorophenyl phenyl either
1,2-Dichlorobenzene	Fluorene
2-Methylphenol	4-Nitroaniline
bis(2-Chloroisopropyl) ether	4,6-Dinitro-2-methylphenol
4-Methylphenol	4-Bromophenyl phenyl ether
N-Nitrosodipropylamine	Hexachlorobenzene
Hexachloroethane	Pentachlorophenol
Nitrobenzene	Phenanthrene
Isophorone	Anthracene
2-Nitrophenol	Di-n-butyl phthalate
2,4-Dimethylphenol	Fluoranthene
Benzoic acid	Pyrene
bis(2-Chloroethyoxy) methane	Butyl benzyl phthalate
2,4-Dichlorophenol	3,3'-Dichlorobenzidine
1,2,4-Trichlorobenzene	Benzo(a)anthracene
Naphthalene	bis(2-ethylhexyl)phthalate
4-Chloroaniline	Chrysene
Hexachlorobutadiene	Di-n-octyl phthalate
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	Benzo(b)fluoranthene
2-Methylnaphthalene	Benzo(k)fluoranthene
Hexachlorocyclopentadiene	Benzo(a)pyrene
2,4,6-Trichlorophenol	Indeno(1,2,3-cd)pyrene
2,4,5-Trichlorophenol	Dibenz(a,h)anthracene
2-Chloronaphthalene	Benzo(g,h,i)perylene
2-Nitroaniline	
Dimethyl phthalate	
Acenaphthylene	
3-Nitroaniline	
Acenaphthene	

TABLE 3-3 (Continued)

TARGET COMPOUND LIST - ROUTINE ANALYTICAL SERVICES

PESTICIDES AND PCBS

Compounds
alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)
Heptachlor
Aldrin
Heptachlor Epoxide
Endosulfan I
Dieldrin
4,4'-DDE
Endrin
Endosulfan II
4,4'-DDD
Endosulfan Sulfate
4,4'-DDT
Endrin Ketone
Methoxychlor
Chlordane
Toxaphene
AROCLOR-1016
AROCLOR-1221
AROCLOR-1232
AROCLOR-1242
AROCLOR-1248
AROCLOR-1254
AROCLOR-1260

TABLE 3-3 (Continued)

TARGET COMPOUND LIST - ROUTINE ANALYTICAL SERVICES

METALS

Element
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

TABLE 3-4

CLP REQUEST FOR GROUNDWATER ANALYSIS

CLP Analyses Requested			Routine Analytical Services (RAS)			
Chemistry Type			Organics			Inorganics
Specific Analyses Requested			TCL VOA's	TCL Semi VOLs (Low conc)	Pesticides and PCBs (low conc)	TCL Metals (low conc)
Preservatives			Chill to 4C	Chill to 4C	Chill to 4C	Chill to 4C Add HNO_3 to pH <2
Analytical Holding Time(s)			Hold <14 days prior to extraction, 40 days after extraction	Hold <14 days prior to extraction, 40 days after extraction	Hold <7 days prior to extraction, 40 days after extraction	Hold <6 months (28 days for Hg)
Contract Holding Time(s)			Hold <10 days prior to extraction, 40 days after extraction	Hold <10 days prior to extraction, 40 days after extraction	Hold <10 days prior to extraction, 40 days after extraction	
Number of Bottles per Analysis			2 x 40 ml glass vial	2 x 1-liter amber glass bottles	2 x 1-liter amber glass bottles	1 x 1-liter polyethylene bottle
Sample Number(s)	Sample Location(s)	Sampling Schedule				
GW-01	GW Wells		27	27	27	27
through	Lab QC Samples*	November	2	2	2	2
GW-31	Equipment Blanks	1988	8	8	8	8
	Replicate Samples		2	2	2	2
OS-01	OS Wells		2	2	2	2
and	Lab QC Samples	November	1	1	1	1
OS-04	Replicate Samples	1988	1	1	1	1

*A double volume of groundwater was collected for lab QC samples.

4.0 PHYSICAL AND CHEMICAL CHARACTERISTICS OF WDI GROUNDWATER

4.1 GROUNDWATER FLOW DIRECTION

Groundwater level elevations at the WDI site were measured several times between September of 1988 and January 1989 although only two sets of measured water level elevations include a sufficient number of data points to be used for development of water level contour maps. These data (Tables 4-1 and 4-2) represent the groundwater level elevations during November 1988 and January 19, 1989. The November 1988 data were obtained during groundwater well development and sampling over a period of one month while the January 19, 1989 data represent the data obtained during one day. Figures 4-1 and 4-2 are groundwater elevation maps constructed from the data. Note that the data used in construction of these maps include only the data from shallow wells and as such represent conditions in the uppermost aquifer underlying the site.

Both water-level-elevation maps indicate that groundwater flow is generally in a southwest direction. These results are consistent with the findings in the 1985 Dames and Moore study. According to this data, near the Campbell property and the Dia-Log property, the flow is slightly to the south and to the west. This indicates that groundwater in these areas may possibly follow along narrow channels with higher permeabilities than the surrounding media.

The November 1988 data indicates a relatively low hydraulic gradient around the reservoir area sloping approximately 0.2 to 0.5 percent in the southwest direction that gradually increases in the direction of the Campbell property. The January 1989 data shows a hydraulic gradient of approximately 0.2 percent. The groundwater velocity could not be estimated since no aquifer test was planned for and conducted during the RI field investigations.

TABLE 4-1

WATER LEVEL ELEVATIONS
NOVEMBER 1988
WASTE DISPOSAL INC.

Well No.	Depth to Groundwater (Feet)	Water Level Elevation (Feet above msl)
GW-01	46.92	106.59
GW-02	46.16	107.29
GW-03	60.66	106.85
GW-04	59.68	107.07
GW-05	59.90	106.77
GW-06	51.82	106.56
GW-07	48.17	106.36
GW-08	48.17	106.28
GW-09	47.59	105.93
GW-11	49.95	104.78
GW-13	51.76	105.76
GW-14	51.87	105.89
GW-15	57.03	106.27
GW-19	53.22	105.67
GW-21	49.69	105.55
GW-22	64.98	91.71
GW-23	60.04	96.94
GW-26	50.77	105.27
GW-27	51.75	105.28
GW-28	52.35	104.96
GW-31	60.15	107.07

Note: Water level elevations for the intermediate and deep wells were not used for groundwater mapping and not included in this table.

TABLE 4-2

WATER LEVEL ELEVATIONS
JANUARY 19, 1989
WASTE DISPOSAL INC.

Well No.*	Depth to Groundwater (Feet)	Water Level Elevation (Feet above msl)
GW-03	61.19	106.57
GW-04	60.21	106.80
GW-05	60.47	106.20
GW-06	52.34	106.04
GW-07	48.68	105.85
GW-08	57.63	105.75
GW-09	48.14	105.38
GW-11	49.67	104.99
GW-13	52.26	105.26
GW-14	52.34	105.33
GW-15	57.67	105.63
GW-16	57.90	105.17
GW-19	53.71	105.45
GW-26	52.41	103.63
GW-27	52.22	104.81
GW-28	52.82	104.81

Note: Water-level elevations reported in this table are for wells that were accessible during the measurement day.

Figure 4-1
GROUNDWATER ELEVATION MAP
NOVEMBER, 1988
WASTE DISPOSAL INC.

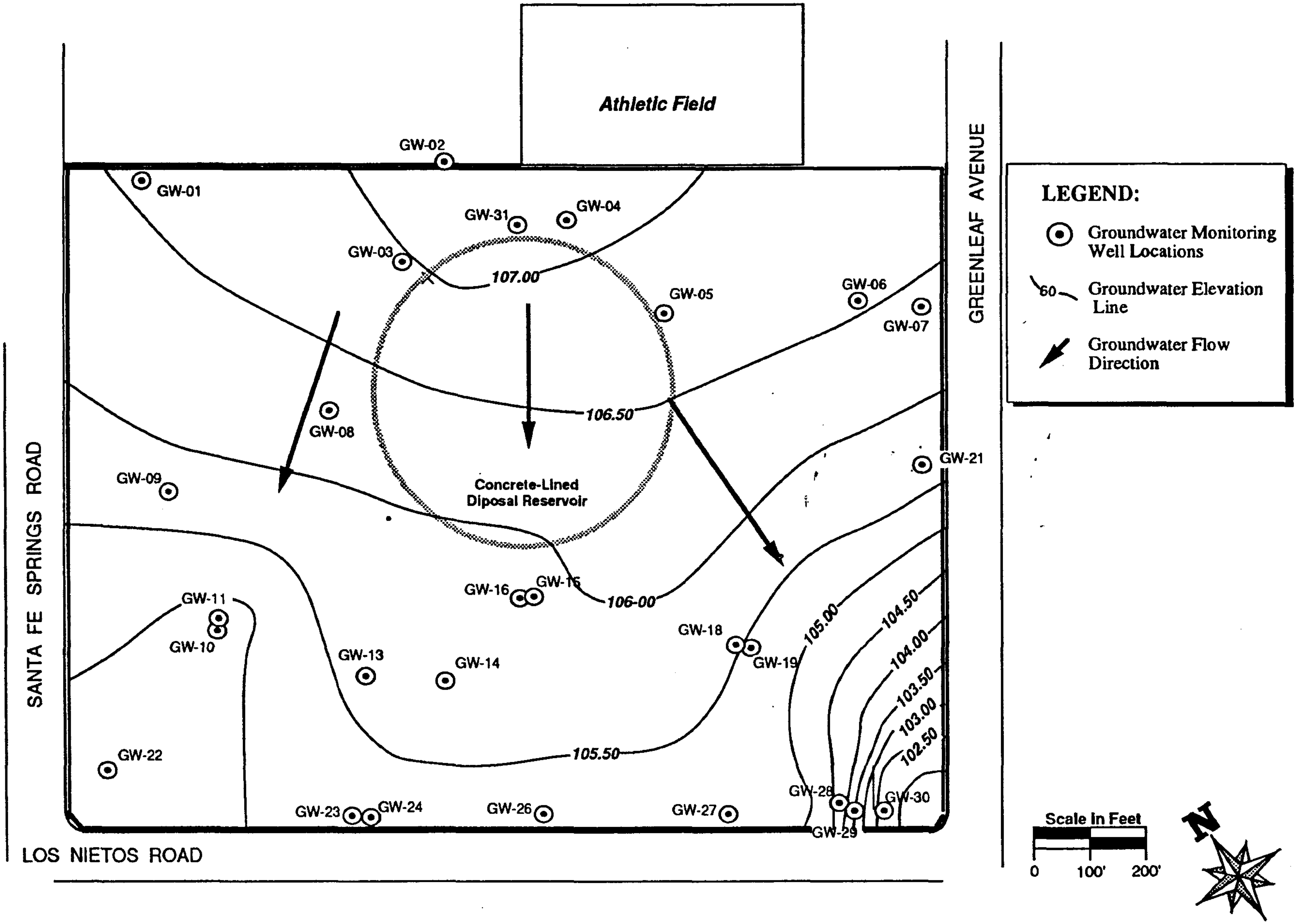

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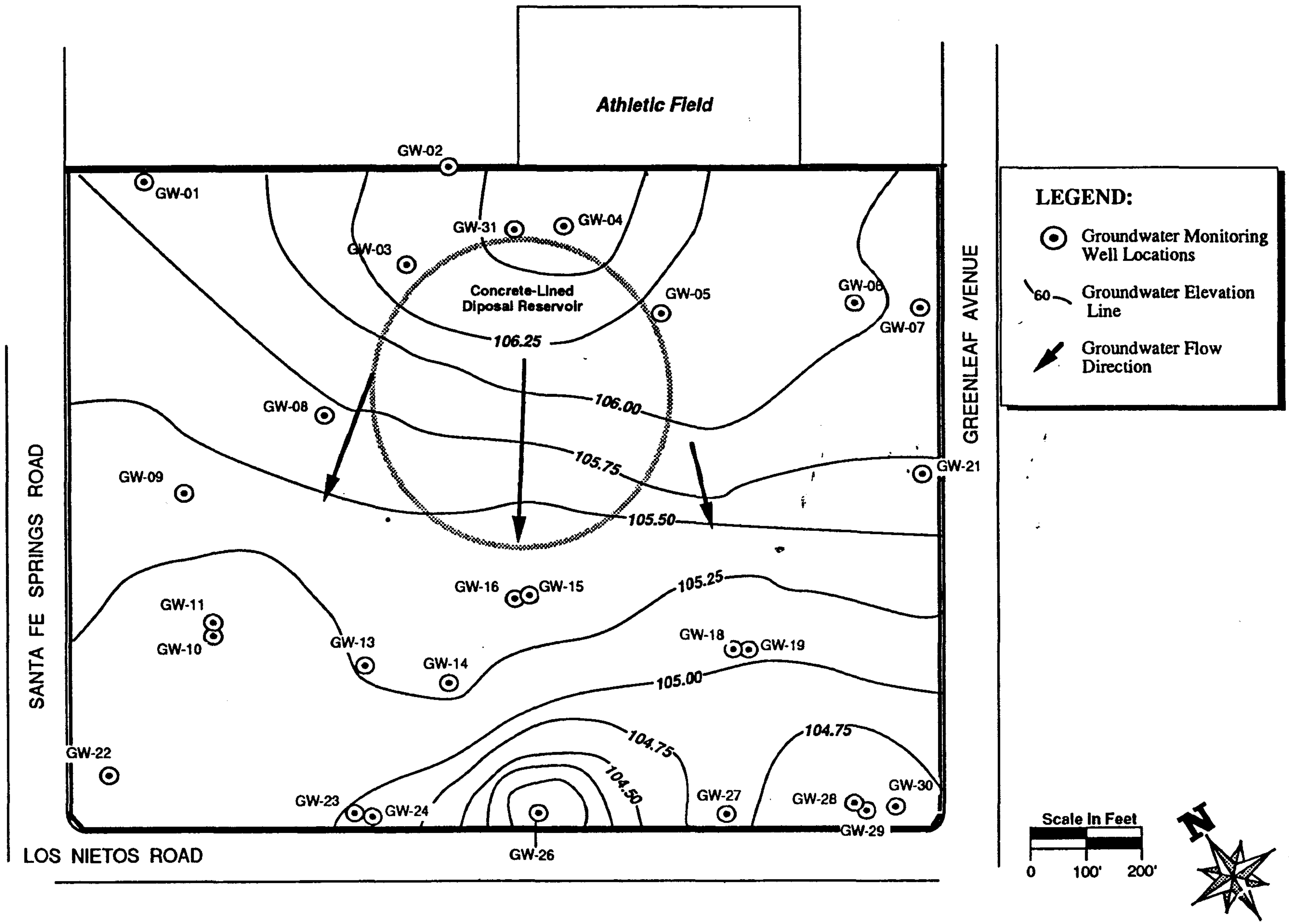
Figure 4-2
GROUNDWATER ELEVATION MAP
JANUARY 19, 1989
WASTE DISPOSAL INC.



E815-L(10)

4.2 GROUNDWATER QUALITY ANALYSES

4.2.1 Drinking Water Standards

EPA has promulgated drinking water regulations designed to protect human health from the potential adverse effects of drinking water contaminants. These drinking water regulations generally apply to community water systems, which are public water systems having at least 15 service connections or serving an average of at least 25 year-round residents.* The drinking water standards and regulations promulgated in July 1987 for eight synthetic organic chemicals (52 FR 25690, July 8, 1987) also apply to a new category of suppliers referred to as non-transient, non-community systems.** These systems are those that regularly serve at least 25 of the same persons over 6 months per year (e.g., rural schools).

Use of MCLs/MCLGs/SMCLs

Primary drinking water regulations include MCLs for specific contaminants. MCLs are enforceable standards which apply to specified contaminants which EPA has determined have an adverse effect on human health. MCLs are set at levels that are protective of human health, and are set as close to MCLGs*** as is feasible taking into account available treatment technologies and the costs to large public water systems. MCLGs, in contrast, are strictly

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* Certain drinking water standards also apply to non-community water systems. These include standards for nitrate, turbidity, microbiological concentrations (40 CFR §141.11, 40 CFR §141.13, and 40 CFR §141.14 respectively).

** EPA plans to continue to extend its drinking water regulations to non-transient, non-community systems.

*** Recommended maximum contaminant levels (RMCLs) were renamed maximum contaminant level goals (MCLGs) by the 1986 Amendments to the Safe Drinking Water Act.

health-based and do not take cost or feasibility into account. As health goals, MCLGs are established at levels at which no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety. To date, MCLs have been promulgated for 30 specific chemicals (10 inorganics, 14 organic chemicals including pesticides, and total trihalomethanes, certain radio-nuclides, coliform bacteria and turbidity). The SDWA amendments of 1986 require EPA to promulgate MCLs for 83 specific contaminants (including reproposal of the earlier-promulgated 30 contaminants with the exception of silver and total trihalomethanes) by June 1989. A list of these 83 contaminants and their promulgation schedule is provided in Table 4-3. MCLGs have been published for 8 organic contaminants and for fluoride. A list of current MCLs and MCLGs is presented in Table 4-4.

For water that is to be used for drinking, the MCLs set under the Safe Drinking Water Act are generally the applicable or relevant and appropriate standard. MCLs are applicable where the water will be provided directly to 25 or more people or will be supplied to 15 or more service connections. If MCLs are applicable, they are applied at the tap. In addition, MCLs are relevant and appropriate as *in situ* cleanup standards where either surface water or ground water is or may be used for drinking water. When no promulgated standard exists for a given contaminant, proposed MCLs are to be given greater consideration among the to-be-considered advisories.

A standard for drinking water more stringent than an MCL may be needed in special circumstances, such as where multiple contaminants in groundwater or multiple pathways of exposure present extraordinary risks (i.e., above an individual lifetime cancer risk of 10^{-4}). In setting a level more stringent than the MCL in such cases, a site-specific determination should be made by considering MCLGs, the Agency's policy on the use of appropriate risk ranges for carcinogens, levels of quantification, and other pertinent guidelines. Prior consultation with Headquarters contacts in the Office of Emergency and Remedial Response or the Office of Waste Programs Enforcement, as appropriate, is encouraged in such cases.

TABLE 4-3

LIST OF 83 CONTAMINANTS FOR WHICH MCLs MUST BE PROMULGATED BY JUNE 1989

9 MCLs Currently Final

Benzene	1,2-Dichloroethane	1,1,1-Trichloroethane
Carbon Tetrachloride	1,1-Dichloroethylene	Trichloroethylene
p-Dichlorobenzene	Fluoride	Vinyl Chloride

40 Contaminants Mandated for MCL Promulgation by June 1988 [a]

Acrylamide	o-Dichlorobenzene	*Lindane
Aldicarb	cis-1,2 Dichloro	*Mercury
Alachlor	ethylene	*Methoxychlor
*Arsenic	trans- 1,2 Dichloro-	*Nitrate
Asbestos	ethylene	PCBs
*Barium	*2,4- Dichlorophenosy-	Pentachlorophenol
*Cadmium	acetic Acid (2,4-D)	*Selenium
Carbofuran	1,2 Dichloropropane	*2,4,5- TP Silvex
Chlordane	Epichlorohydrin	Styrene
Chlorobenzene	Ethyl Benzene	Toluene
*Chromium	Ethylene Dibromide	*Toxaphene
*Coliform Bacteria	Giardia Lamblia	*Turbidity
Copper	Heptachlor	Viruses
Dibromochloropropane	Heptachlor Epoxide	Xylene
(DBCP)	*Lead	

34 Contaminants Mandated for MCL Promulgation by June 1989

Adipates	*Endrin	*Radium 226 and 228
Aldicarb Sulfone	Endothall	Radon
Aldicarb Sulfoxide	Glyphosate	Simazine
Antimony	*Gross alpha particle	Standard Plate Count
Atrazine	activity	Sulfate
Berlyllium	Hexochlorocyclopentadiene	2,3,7,8 - TCDD (Dioxin)
*Beta particle - Photon	Legionella	Tetrachloroethylene
Radioactivity	Methylene Chloride	Thallium
Cyanide	Nickel	Trichlorobenzine
Dalapon	PAHs	1,1,2 - Trichloroethane
Dinoseb	Phthalates	Uranium
Diquat	Pichloram	vydate

* 19 MCLs to be reproposed.

[a] At the time of this report, no MCLs for these contaminants had been proposed or promulgated under SDWA amendments of 1986.

TABLE 4-4

CURRENT MAXIMUM CONTAMINANT LEVELS (MCLs) AND
MAXIMUM CONTAMINANT LEVEL GOALS (MCLGs)

Contaminant	MCL (in ppb)	MCLG (in ppb)
Aluminum	1,000	
Arsenic	50	
Barium	1,000	
Chromium	50	
Copper	1,000	
Iron	300	
Lead	50	
Manganese	50	
Mercury	2	
Selenium	10	
Silver	50	
Zinc	5,000	
Toluene	100	
Trichloroethene	5	

The responsibility for enforcing primary drinking water regulations resides with the appropriate State government agency in those States where EPA has granted the State primary enforcement authority or with EPA in the two States that do not have primary enforcement (Indiana and Wyoming). Suppliers of water may be assessed criminal or civil penalties for violations of primary drinking water regulations. In addition, suppliers are required to notify the public regarding violations of primary drinking water standards.

Secondary drinking water regulations consist primarily of Secondary Maximum Contaminant Levels (SMCLs) for specific contaminants or water characteristics that may affect the aesthetic qualities of drinking water (i.e., color, odor, and taste). SMCLs are nonenforceable limits intended as guidelines for use by states in regulating water supplies. SMCLs apply to public water systems and are measured at the tap of the user of the system. A list of existing SMCLs is presented in Table 4-5. For States that have adopted SMCLs as additional drinking water standards, SMCLs are potential State ARARs, depending on site conditions.

4.2.2 Background Contamination

Samples of groundwater were collected from GW-01 and GW-02, both wells which are installed upgradient of the WDI reservoir. The analysis of water samples from these wells is reported in Table 4-6. As in seen in this table, aluminum, and selenium were found in both of these wells in concentrations above the Safe Drinking Water Act (SDWA), Primary Maximum Contaminant Level (MCL), standards. The concentrations of iron and manganese in these wells also exceed the Secondary Maximum Contaminant Levels (MCL). Chromium was detected in concentrations above the MCL standard in well GW-01 only. Arsenic, barium, copper, lead and zinc were found in both upgradient wells but at concentrations lower than the MCL standards. Calcium, magnesium, potassium and sodium were also found in both wells. Concentrations of cobalt, nickel, and vanadium were also detected. Volatile organics, semivolatile organics and pesticides/PCB compounds were not detected in these upgradient wells.

TABLE 4-5

SECONDARY MAXIMUM CONTAMINANT LEVELS (SMCLs)
UNDER THE SAFE DRINKING WATER ACT

Contaminant	Level
Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	Noncorrosive
Fluoride	2.0 mg/l
Foaming agent	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold odor number
pH	6.5-8.5
Sulfate	250 mg/l
Total dissolved solids	500 mg/l
Zinc	5 mg/l

Source: 40 CFR §143.3.

TABLE 4-6

BACKGROUND CHEMICAL CONCENTRATIONS
UPGRADIENT GROUNDWATER MONITORING WELLS
WASTE DISPOSAL INC.

Parameter	GW-001-001 Value (ug/l)	GW-002-001 Value (ug/l)
Aluminum	48,400.00	3,570.00
Antimony	3.60	2.00
Arsenic	25.00	3.40
Barium	907.00	125.000
Beryllium	2.00	2.00
Cadmium	5.00	5.00
Calcium	354,000.00	243,000.00
Chromium	91.30	26.80
Cobalt	49.00	15.00
Copper	127.00	12.40
Iron	79,300.00	6,110.00
Lead	34.00	3.60
Magnesium	114,000.00	66,300.00
Manganese	2,550.00	183.00
Mercury	0.20	0.20
Nickel	79.40	26.70
Potassium	18,400.00	7,250.00
Selenium	80.10	20.40
Silver	7.00	7.00
Sodium	158,000.00	129,000.00
Thallium	2.00	2.00
Vanadium	154.00	20.00
Zinc	307.00	202.00

4.2.3 Onsite Contamination

4.2.3.1 Metals

In accordance with EPA's policy, all samples from upgradient and downgradient of source areas were unfiltered. The suspended particles in unfiltered samples are sometimes part of the subsurface formation and may be derived from the surrounding sediments. As a result, the analysis of unfiltered samples, particularly for metals, may not be representative of chemicals which are in true solution, or of groundwater contamination. Nonetheless, this analysis usually results in a conservative estimate of public health risks from drinking groundwater.

Numerous metals were detected in samples collected from groundwater monitoring wells located within the WDI site boundaries (see Table 4-7 and Figures 4-3 through 4-17). The following discussion summarizes the significance of these results:

- o Aluminum was detected in twenty five (25) of twenty seven (27) groundwater monitoring wells. Twenty three (23) wells show aluminum concentrations above the MCL of 1000 ppb established by the Safe Drinking Water Act. Aluminum was also detected in the upgradient wells.

- o Arsenic, barium, copper, lead, mercury, silver and zinc were found in more than one well but at concentrations below the MCLs.

- o Calcium was found in all wells. Concentration of calcium ranges from 187 to 354 ppm. The highest concentration was found in GW-01 which is an upgradient well.

- o Chromium was detected in nineteen wells but only GW-01 which is an upgradient well and GW-27 which is located near the southern end of the site, contain concentrations above the MCL standard.

- o Cobalt was found in wells GW-01 (49 ppb), GW-09 (21 ppb) and GW-23 (16 ppb).

TABLE 4-7
CONCENTRATIONS OF METALS IN GROUNDWATER
WDI SITE

	SAMPLE LOCATION	LAB I.D.	VALUE	DETECT *	MAXIMUM CONTAMINANT LEVELS**
** Aluminum					
	GW-001-001	MYD305	48400.00	J	1000 ppb
	GW-002-001	MYD263	3570.00	J	1000 ppb
	GW-003-001	MYD563	2640.00	J	1000 ppb
	GW-004-001	MYD555	326.00	J	1000 ppb
	GW-005-001	MYD554	1720.00	J	1000 ppb
	GW-006-001	MYD562	3090.00	J	1000 ppb
	GW-007-001	MYD561	1600.00	J	1000 ppb
	GW-008-001	MYD565	1090.00	J	1000 ppb
	GW-009-001	MYD304 D1	12100.00	J	1000 ppb
	GW-009-002	MYD553 D1	15200.00	J	1000 ppb
	GW-010-001	MYD557	6040.00	J	1000 ppb
	GW-011-001	MYD321	2350.00		1000 ppb
	GW-013-001	MYD265	1380.00	J	1000 ppb
	GW-014-001	MYD309	1250.00	J	1000 ppb
	GW-015-001	MYD564	10900.00	J	1000 ppb
	GW-016-001	MYD320	217.00		1000 ppb
	GW-019-001	MYD314 D1	2890.00	J	1000 ppb
	GW-019-002	MYD313 D1	2150.00	J	1000 ppb
	GW-021-001	MYD308	2600.00	J	1000 ppb
	GW-022-001	MYD558	9930.00	J	1000 ppb
	GW-023-001	MYD307	14600.00	J	1000 ppb
	GW-026-001	MYD311	8860.00	J	1000 ppb
	GW-027-001	MYD312	9850.00	J	1000 ppb
	GW-028-001	MYD318	22600.00		1000 ppb
	GW-029-001	MYD317	1030.00		1000 ppb
	GW-030-001	MYD316	11500.00		1000 ppb
	GW-031-001	MYD560	1600.00	J	1000 ppb
** Antimony					
	GW-001-001	MYD305	3.60	L J	N/A
	GW-009-002	MYD553 D1	2.80	L J	N/A
	GW-021-001	MYD308	2.10	L J	N/A
	GW-023-001	MYD307	2.10	L J	N/A
** Arsenic					
	GW-001-001	MYD305	25.00		50 ppb
	GW-002-001	MYD263	3.40	L J	50 ppb
	GW-003-001	MYD563	4.00	L J	50 ppb
	GW-005-001	MYD554	2.90	L J	50 ppb
	GW-006-001	MYD562	3.00	L J	50 ppb
	GW-008-001	MYD565	12.00		50 ppb
	GW-009-001	MYD304 D1	8.40	L J	50 ppb
	GW-009-002	MYD553 D1	13.10		50 ppb
	GW-010-001	MYD557	8.00	L J	50 ppb
	GW-015-001	MYD564	11.00		50 ppb
	GW-019-001	MYD314 D1	3.00	L J	50 ppb

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
GW-019-002	MYD313 D1	2.00	L	J	50 ppb
GW-021-001	MYD308	6.60	L	J	50 ppb
GW-022-001	MYD558	11.00			50 ppb
GW-023-001	MYD307	9.50	L	J	50 ppb
GW-026-001	MYD311	8.00	L	J	50 ppb
GW-027-001	MYD312	7.00	L	J	50 ppb
GW-028-001	MYD318	7.00	L	J	50 ppb
GW-030-001	MYD316	7.00	L	J	50 ppb
** Barium					
GW-001-001	MYD305	907.00			1000 ppb
GW-002-001	MYD263	125.00	L	J	1000 ppb
GW-003-001	MYD563	85.00	L	J	1000 ppb
GW-004-001	MYD555	36.10	L	J	1000 ppb
GW-005-001	MYD554	43.00	L	J	1000 ppb
GW-006-001	MYD562	80.00	L	J	1000 ppb
GW-007-001	MYD561	76.00	L	J	1000 ppb
GW-008-001	MYD565	53.00	L	J	1000 ppb
GW-009-001	MYD304 D1	221.00			1000 ppb
GW-009-002	MYD553 D1	288.00			1000 ppb
GW-010-001	MYD557	182.00	L	J	1000 ppb
GW-011-001	MYD321	49.00	L	J	1000 ppb
GW-013-001	MYD265	51.00	L	J	1000 ppb
GW-014-001	MYD309	44.50	L	J	1000 ppb
GW-015-001	MYD564	157.00	L	J	1000 ppb
GW-019-001	MYD314 D1	73.00	L	J	1000 ppb
GW-019-002	MYD313 D1	61.00	L	J	1000 ppb
GW-021-001	MYD308	99.70	L	J	1000 ppb
GW-022-001	MYD558	206.00			1000 ppb
GW-023-001	MYD307	185.00	L	J	1000 ppb
GW-026-001	MYD311	231.00			1000 ppb
GW-027-001	MYD312	150.00	L	J	1000 ppb
GW-028-001	MYD318	242.00			1000 ppb
GW-030-001	MYD316	145.00	L	J	1000 ppb
GW-031-001	MYD560	81.00	L	J	1000 ppb
** Calcium					
GW-001-001	MYD305	354000.0			N/A
GW-002-001	MYD263	243000.0			N/A
GW-003-001	MYD563	231000.0			N/A
GW-004-001	MYD555	284000.0			N/A
GW-005-001	MYD554	288000.0			N/A
GW-006-001	MYD562	204000.0			N/A
GW-007-001	MYD561	187000.0			N/A
GW-008-001	MYD565	238000.0			N/A
GW-009-001	MYD304 D1	309000.0			N/A
GW-009-002	MYD553 D1	300000.0			N/A

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
GW-010-001	MYD557	301000.0			N/A
GW-011-001	MYD321	299000.0			N/A
GW-013-001	MYD265	270000.0			N/A
GW-014-001	MYD309	279000.0			N/A
GW-015-001	MYD564	256000.0			N/A
GW-016-001	MYD320	245000.0			N/A
GW-018-001	MYD319	244000.0			N/A
GW-019-001	MYD314 D1	298000.0			N/A
GW-019-002	MYD313 D1	295000.0			N/A
GW-021-001	MYD308	255000.0			N/A
GW-022-001	MYD558	314000.0			N/A
GW-023-001	MYD307	280000.0			N/A
GW-024-001	MYD322	247000.0			N/A
GW-026-001	MYD311	261000.0			N/A
GW-027-001	MYD312	281000.0			N/A
GW-028-001	MYD318	251000.0			N/A
GW-029-001	MYD317	235000.0			N/A
GW-030-001	MYD316	192000.0			N/A
GW-031-001	MYD560	272000.0			N/A
GW-050-001	MYD306 FB	42.00	L	J	N/A
** Chromium					
GW-001-001	MYD305	91.30			50 ppb
GW-002-001	MYD263	26.80		J	50 ppb
GW-003-001	MYD563	13.00		J	50 ppb
GW-004-001	MYD555	10.00		J	50 ppb
GW-006-001	MYD562	16.00		J	50 ppb
GW-008-001	MYD565	8.00	L	J	50 ppb
GW-009-001	MYD304 D1	21.20		J	50 ppb
GW-009-002	MYD553 D1	25.40		J	50 ppb
GW-010-001	MYD557	13.00		J	50 ppb
GW-013-001	MYD265	11.90			50 ppb
GW-015-001	MYD564	25.00		J	50 ppb
GW-019-001	MYD314 D1	18.00		J	50 ppb
GW-019-002	MYD313 D1	9.00	L	J	50 ppb
GW-021-001	MYD308	8.80	L	J	50 ppb
GW-022-001	MYD558	17.00		J	50 ppb
GW-023-001	MYD307	33.10			50 ppb
GW-026-001	MYD311	33.00		J	50 ppb
GW-027-001	MYD312	53.00			50 ppb
GW-028-001	MYD318	24.40			50 ppb
GW-030-001	MYD316	33.30			50 ppb
GW-031-001	MYD560	17.00		J	50 ppb
GW-050-001	MYD306 FB	13.00			50 ppb
** Cobalt					
GW-001-001	MYD305	49.00	L	J	N/A

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

	SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
	GW-009-001	MYD304 D1	15.40	L	J	N/A
	GW-009-002	MYD553 D1	21.50	L	J	N/A
	GW-023-001	MYD307	16.40	L	J	N/A
** Copper						
	GW-001-001	MYD305	127.00			1000 ppb
	GW-002-001	MYD263	12.40	L	J	1000 ppb
	GW-003-001	MYD563	13.00	L	J	1000 ppb
	GW-004-001	MYD555	8.20	L	J	1000 ppb
	GW-005-001	MYD554	8.80	L	J	1000 ppb
	GW-006-001	MYD562	11.00	L	J	1000 ppb
	GW-007-001	MYD561	10.00	L	J	1000 ppb
	GW-008-001	MYD565	9.00	L	J	1000 ppb
	GW-009-001	MYD304 D1	29.80			1000 ppb
	GW-009-002	MYD553 D1	40.40			1000 ppb
	GW-010-001	MYD557	25.00			1000 ppb
	GW-013-001	MYD265	12.10	L	J	1000 ppb
	GW-014-001	MYD309	12.60	L	J	1000 ppb
	GW-015-001	MYD564	36.00			1000 ppb
	GW-019-001	MYD314 D1	26.00			1000 ppb
	GW-019-002	MYD313 D1	15.00	L	J	1000 ppb
	GW-021-001	MYD308	14.40	L	J	1000 ppb
	GW-022-001	MYD558	29.00			1000 ppb
	GW-023-001	MYD307	32.10			1000 ppb
	GW-026-001	MYD311	28.00			1000 ppb
	GW-027-001	MYD312	28.00			1000 ppb
	GW-028-001	MYD318	46.70			1000 ppb
	GW-030-001	MYD316	25.40			1000 ppb
	GW-031-001	MYD560	11.00	L	J	1000 ppb
** Iron						
	GW-001-001	MYD305	79300.00		J	300 ppb
	GW-002-001	MYD263	6110.00		J	300 ppb
	GW-003-001	MYD563	4550.00		J	300 ppb
	GW-004-001	MYD555	548.00		J	300 ppb
	GW-005-001	MYD554	2790.00		J	300 ppb
	GW-006-001	MYD562	5240.00		J	300 ppb
	GW-007-001	MYD561	2770.00		J	300 ppb
	GW-008-001	MYD565	1830.00		J	300 ppb
	GW-009-001	MYD304 D1	17300.00		J	300 ppb
	GW-009-002	MYD553 D1	23100.00		J	300 ppb
	GW-010-001	MYD557	10600.00		J	300 ppb
	GW-011-001	MYD321	3500.00			300 ppb
	GW-013-001	MYD265	2060.00		J	300 ppb
	GW-014-001	MYD309	1840.00		J	300 ppb
	GW-015-001	MYD564	19200.00		J	300 ppb
	GW-016-001	MYD320	218.00			300 ppb

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

	SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
	GW-018-001	MYD319	221.00			300 ppb
	GW-019-001	MYD314 D1	4550.00		J	300 ppb
	GW-019-002	MYD313 D1	3420.00		J	300 ppb
	GW-021-001	MYD308	3960.00		J	300 ppb
	GW-022-001	MYD558	15500.00		J	300 ppb
	GW-023-001	MYD307	18800.00		J	300 ppb
	GW-026-001	MYD311	14700.00		J	300 ppb
	GW-027-001	MYD312	15500.00		J	300 ppb
	GW-028-001	MYD318	34100.00			300 ppb
	GW-029-001	MYD317	1380.00			300 ppb
	GW-030-001	MYD316	20200.00			300 ppb
	GW-031-001	MYD560	2360.00		J	300 ppb
	GW-050-001	MYD306 FB	100.00		J	300 ppb
** Lead						
	GW-001-001	MYD305	34.00		J	50 ppb
	GW-002-001	MYD263	3.60	L	J	50 ppb
	GW-003-001	MYD563	6.00		J	50 ppb
	GW-006-001	MYD562	5.00	L	J	50 ppb
	GW-007-001	MYD561	3.00	L	J	50 ppb
	GW-008-001	MYD565	3.00	L	J	50 ppb
	GW-009-001	MYD304 D1	3.60	L	J	50 ppb
	GW-009-002	MYD553 D1	3.70	L	J	50 ppb
	GW-010-001	MYD557	4.00	L	J	50 ppb
	GW-013-001	MYD265	2.20	L	J	50 ppb
	GW-015-001	MYD564	13.00		J	50 ppb
	GW-016-001	MYD320	1.70	L	J	50 ppb
	GW-018-001	MYD319	1.80	L	J	50 ppb
	GW-019-001	MYD314 D1	4.00	L	J	50 ppb
	GW-019-002	MYD313 D1	4.00	L	J	50 ppb
	GW-022-001	MYD558	12.00		J	50 ppb
	GW-023-001	MYD307	4.30	L	J	50 ppb
	GW-024-001	MYD322	1.50	L	J	50 ppb
	GW-026-001	MYD311	12.00		J	50 ppb
	GW-027-001	MYD312	10.00		J	50 ppb
	GW-028-001	MYD318	16.30			50 ppb
	GW-029-001	MYD317	7.80			50 ppb
	GW-030-001	MYD316	11.30			50 ppb
	GW-031-001	MYD560	3.00	L	J	50 ppb
** Magnesium						
	GW-001-001	MYD305	114000.0			N/A
	GW-002-001	MYD263	66300.00			N/A
	GW-003-001	MYD563	67900.00			N/A
	GW-004-001	MYD555	76400.00			N/A
	GW-005-001	MYD554	73700.00			N/A
	GW-006-001	MYD562	62300.00			N/A

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

SAMPLE LOCATION	LAB I.D.	VALUE	DETECT	MAXIMUM CONTAMINANT LEVELS
GW-007-001	MYD561	59200.00		N/A
GW-008-001	MYD565	67300.00		N/A
GW-009-001	MYD304 D1	81400.00		N/A
GW-009-002	MYD553 D1	78100.00		N/A
GW-010-001	MYD557	77400.00		N/A
GW-011-001	MYD321	81500.00		N/A
GW-013-001	MYD265	67100.00		N/A
GW-014-001	MYD309	70300.00		N/A
GW-015-001	MYD564	75200.00		N/A
GW-016-001	MYD320	75900.00		N/A
GW-018-001	MYD319	76300.00		N/A
GW-019-001	MYD314 D1	82000.00		N/A
GW-019-002	MYD313 D1	80900.00		N/A
GW-021-001	MYD308	69800.00		N/A
GW-022-001	MYD558	72900.00		N/A
GW-023-001	MYD307	77300.00		N/A
GW-024-001	MYD322	68300.00		N/A
GW-026-001	MYD311	76700.00		N/A
GW-027-001	MYD312	82000.00		N/A
GW-028-001	MYD318	88300.00		N/A
GW-029-001	MYD317	75000.00		N/A
GW-030-001	MYD316	70900.00		N/A
GW-031-001	MYD560	74000.00		N/A

** Manganese

SAMPLE LOCATION	LAB I.D.	VALUE	DETECT	MAXIMUM CONTAMINANT LEVELS
GW-001-001	MYD305	2550.00	J	50 ppb
GW-002-001	MYD263	183.00	J	50 ppb
GW-003-001	MYD563	156.00		50 ppb
GW-004-001	MYD555	70.60	J	50 ppb
GW-005-001	MYD554	2000.00	J	50 ppb
GW-006-001	MYD562	194.00		50 ppb
GW-007-001	MYD561	103.00		50 ppb
GW-008-001	MYD565	2620.00		50 ppb
GW-009-001	MYD304 D1	619.00	J	50 ppb
GW-009-002	MYD553 D1	887.00	J	50 ppb
GW-010-001	MYD557	2510.00		50 ppb
GW-011-001	MYD321	230.00		50 ppb
GW-013-001	MYD265	5560.00	J	50 ppb
GW-014-001	MYD309	5850.00	J	50 ppb
GW-015-001	MYD564	4010.00		50 ppb
GW-016-001	MYD320	20.80		50 ppb
GW-018-001	MYD319	38.80		50 ppb
GW-019-001	MYD314 D1	2930.00		50 ppb
GW-019-002	MYD313 D1	2590.00		50 ppb
GW-021-001	MYD308	4160.00	J	50 ppb
GW-022-001	MYD558	667.00		50 ppb
GW-023-001	MYD307	1650.00	J	50 ppb

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
GW-024-001	MYD322	8.40	L	J	50 ppb
GW-026-001	MYD311	1090.00			50 ppb
GW-027-001	MYD312	1030.00			50 ppb
GW-028-001	MYD318	731.00			50 ppb
GW-029-001	MYD317	123.00			50 ppb
GW-030-001	MYD316	658.00			50 ppb
GW-031-001	MYD560	62.00			50 ppb
GW-050-001	MYD306 FB	6.30	L	J	50 ppb
** Mercury					
GW-022-001	MYD558	2.00		J	2 ppb
GW-023-001	MYD307	0.45			2 ppb
GW-024-001	MYD322	0.53			2 ppb
GW-026-001	MYD311	0.00		J	2 ppb
GW-028-001	MYD318	0.36			2 ppb
GW-029-001	MYD317	0.31			2 ppb
GW-030-001	MYD316	0.21			2 ppb
** Nickel					
GW-001-001	MYD305	79.40			N/A
GW-002-001	MYD263	26.70	L	J	N/A
GW-003-001	MYD563	23.00	L	J	N/A
GW-008-001	MYD565	24.00	L	J	N/A
GW-009-001	MYD304 D1	24.50	L	J	N/A
GW-009-002	MYD553 D1	29.10	L	J	N/A
GW-015-001	MYD564	28.00	L	J	N/A
GW-019-002	MYD313 D1	31.00	L	J	N/A
GW-022-001	MYD558	45.00		J	N/A
GW-023-001	MYD307	36.80	L	J	N/A
GW-026-001	MYD311	30.00	L	J	N/A
GW-027-001	MYD312	37.00	L	J	N/A
GW-050-001	MYD306 FB	22.80	L	J	N/A
** Potassium					
GW-001-001	MYD305	18400.00			N/A
GW-002-001	MYD263	7250.00			N/A
GW-003-001	MYD563	5690.00			N/A
GW-004-001	MYD555	5800.00			N/A
GW-005-001	MYD554	5880.00			N/A
GW-006-001	MYD562	6450.00			N/A
GW-007-001	MYD561	5270.00			N/A
GW-008-001	MYD565	4500.00	L	J	N/A
GW-009-001	MYD304 D1	9140.00			N/A
GW-009-002	MYD553 D1	8450.00			N/A
GW-010-001	MYD557	7790.00			N/A
GW-011-001	MYD321	4880.00	L	J	N/A
GW-013-001	MYD265	5210.00			N/A

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
GW-014-001	MYD309	4900.00	L	J	N/A
GW-015-001	MYD564	8110.00			N/A
GW-016-001	MYD320	3820.00	L	J	N/A
GW-018-001	MYD319	4870.00	L	J	N/A
GW-019-001	MYD314 D1	5970.00			N/A
GW-019-002	MYD313 D1	6100.00			N/A
GW-021-001	MYD308	5500.00			N/A
GW-022-001	MYD558	8650.00			N/A
GW-023-001	MYD307	8990.00			N/A
GW-024-001	MYD322	1950.00	L	J	N/A
GW-026-001	MYD311	8270.00			N/A
GW-027-001	MYD312	9260.00			N/A
GW-028-001	MYD318	8880.00			N/A
GW-029-001	MYD317	5180.00			N/A
GW-030-001	MYD316	7940.00			N/A
GW-031-001	MYD560	6140.00			N/A
GW-050-001	MYD306 FB	1140.00	L	J	N/A
** Selenium					
GW-001-001	MYD305	80.10		J	10 ppb
GW-002-001	MYD263	20.40		J	10 ppb
GW-003-001	MYD563	20.00			10 ppb
GW-004-001	MYD555	47.50		J	10 ppb
GW-005-001	MYD554	30.30		J	10 ppb
GW-006-001	MYD562	32.00			10 ppb
GW-007-001	MYD561	26.00			10 ppb
GW-008-001	MYD565	9.00			10 ppb
GW-009-001	MYD304 D1	62.80		J	10 ppb
GW-009-002	MYD553 D1	54.20		J	10 ppb
GW-010-001	MYD557	24.00			10 ppb
GW-011-001	MYD321	66.60			10 ppb
GW-014-001	MYD309	17.90		J	10 ppb
GW-015-001	MYD564	27.00			10 ppb
GW-016-001	MYD320	47.00			10 ppb
GW-018-001	MYD319	37.50			10 ppb
GW-019-001	MYD314 D1	33.00			10 ppb
GW-019-002	MYD313 D1	31.00			10 ppb
GW-021-001	MYD308	42.80		J	10 ppb
GW-022-001	MYD558	13.00			10 ppb
GW-023-001	MYD307	44.70		J	10 ppb
GW-024-001	MYD322	20.50			10 ppb
GW-026-001	MYD311	19.00			10 ppb
GW-027-001	MYD312	29.00			10 ppb
GW-028-001	MYD318	44.20			10 ppb
GW-029-001	MYD317	42.50			10 ppb
GW-030-001	MYD316	29.90			10 ppb
GW-031-001	MYD560	24.00			10 ppb

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

	SAMPLE LOCATION	LAB I.D.	VALUE	DETECT		MAXIMUM CONTAMINANT LEVELS
** Silver						
	GW-010-001	MYD557	10.00	L	J	50 ppb
	GW-022-001	MYD558	8.00	L	J	50 ppb
** Sodium						
	GW-001-001	MYD305	158000.0			N/A
	GW-002-001	MYD263	129000.0			N/A
	GW-003-001	MYD563	116000.0			N/A
	GW-004-001	MYD555	184000.0			N/A
	GW-005-001	MYD554	154000.0			N/A
	GW-006-001	MYD562	190000.0			N/A
	GW-007-001	MYD561	180000.0			N/A
	GW-008-001	MYD565	130000.0			N/A
	GW-009-001	MYD304 D1	144000.0			N/A
	GW-009-002	MYD553 D1	140000.0			N/A
	GW-010-001	MYD557	170000.0			N/A
	GW-011-001	MYD321	150000.0		J	N/A
	GW-013-001	MYD265	143000.0			N/A
	GW-014-001	MYD309	147000.0			N/A
	GW-015-001	MYD564	127000.0			N/A
	GW-016-001	MYD320	158000.0		J	N/A
	GW-018-001	MYD319	163000.0		J	N/A
	GW-019-001	MYD314 D1	153000.0			N/A
	GW-019-002	MYD313 D1	149000.0			N/A
	GW-021-001	MYD308	193000.0			N/A
	GW-022-001	MYD558	143000.0			N/A
	GW-023-001	MYD307	148000.0			N/A
	GW-024-001	MYD322	149000.0		J	N/A
	GW-026-001	MYD311	183000.0			N/A
	GW-027-001	MYD312	160000.0			N/A
	GW-028-001	MYD318	149000.0		J	N/A
	GW-029-001	MYD317	161000.0		J	N/A
	GW-030-001	MYD316	102000.0		J	N/A
	GW-031-001	MYD560	142000.0			N/A
	GW-050-001	MYD306 FB	221.00	L	J	N/A
** Vanadium						
	GW-001-001	MYD305	154.00			N/A
	GW-009-001	MYD304 D1	34.20	L	J	N/A
	GW-009-002	MYD553 D1	52.30			N/A
	GW-010-001	MYD557	25.00	L	J	N/A
	GW-015-001	MYD564	39.00	L	J	N/A
	GW-019-001	MYD314 D1	22.00	L	J	N/A
	GW-022-001	MYD558	36.00	L	J	N/A
	GW-023-001	MYD307	39.40	L	J	N/A
	GW-026-001	MYD311	30.00	L	J	N/A

TABLE 4-7
CONCENTRATIONS OF
METALS IN GROUNDWATER
WDI SITE

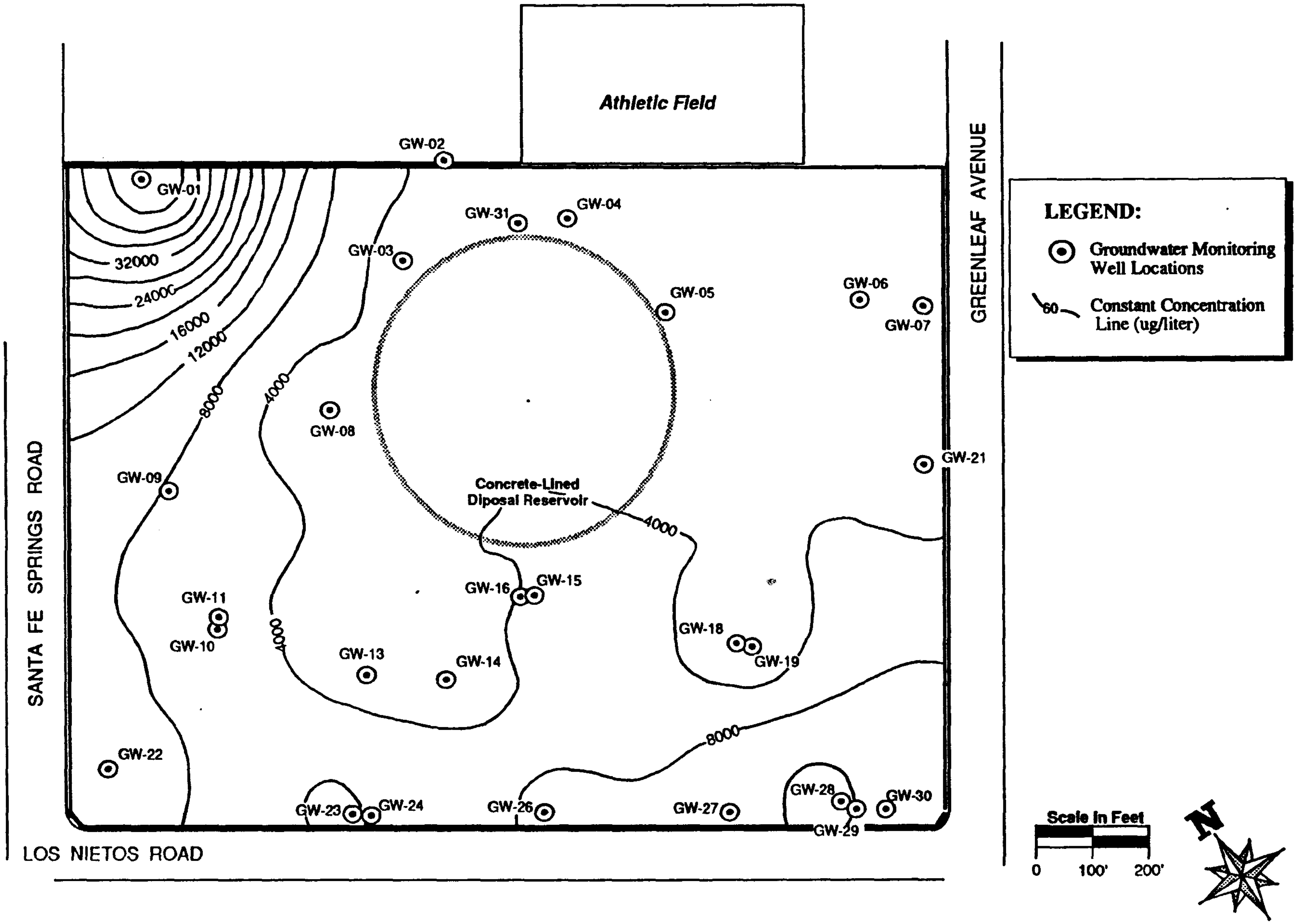
SAMPLE LOCATION	LAB I.D.	VALUE	DETECT	MAXIMUM CONTAMINANT LEVELS
GW-027-001	MYD312	41.00	L J	N/A
GW-028-001	MYD318	69.60		N/A
** Zinc				
GW-001-001	MYD305	307.00	J	5000 ppb
GW-002-001	MYD263	202.00	J	5000 ppb
GW-003-001	MYD563	56.00		5000 ppb
GW-004-001	MYD555	41.10	J	5000 ppb
GW-005-001	MYD554	39.90	J	5000 ppb
GW-006-001	MYD562	51.00		5000 ppb
GW-007-001	MYD561	34.00		5000 ppb
GW-008-001	MYD565	46.00		5000 ppb
GW-009-001	MYD304 D1	56.70	J	5000 ppb
GW-009-002	MYD553 D1	88.40	J	5000 ppb
GW-010-001	MYD557	59.00		5000 ppb
GW-011-001	MYD321	70.30		5000 ppb
GW-013-001	MYD265	55.00	J	5000 ppb
GW-014-001	MYD309	36.60	J	5000 ppb
GW-015-001	MYD564	92.00		5000 ppb
GW-016-001	MYD320	48.00		5000 ppb
GW-018-001	MYD319	27.90		5000 ppb
GW-019-001	MYD314 D1	58.00		5000 ppb
GW-019-002	MYD313 D1	42.00		5000 ppb
GW-021-001	MYD308	73.60	J	5000 ppb
GW-022-001	MYD558	71.00		5000 ppb
GW-023-001	MYD307	81.60	J	5000 ppb
GW-026-001	MYD311	66.00		5000 ppb
GW-027-001	MYD312	93.00		5000 ppb
GW-028-001	MYD318	111.00		5000 ppb
GW-029-001	MYD317	30.70		5000 ppb
GW-030-001	MYD316	63.00		5000 ppb
GW-031-001	MYD560	82.00		5000 ppb

* J Values are estimated, data is valid for <u>limited</u> purposes. The results are qualitatively acceptable unless otherwise noted.

L Results have been qualified because they fall between the Contract Required Quantitation Limit (CRQL) and the Instrument Detection Limit (IDL). These results for compounds which are present, but are quantitatively unreliable due to the uncertainty of analytical precision close to the detection limit.

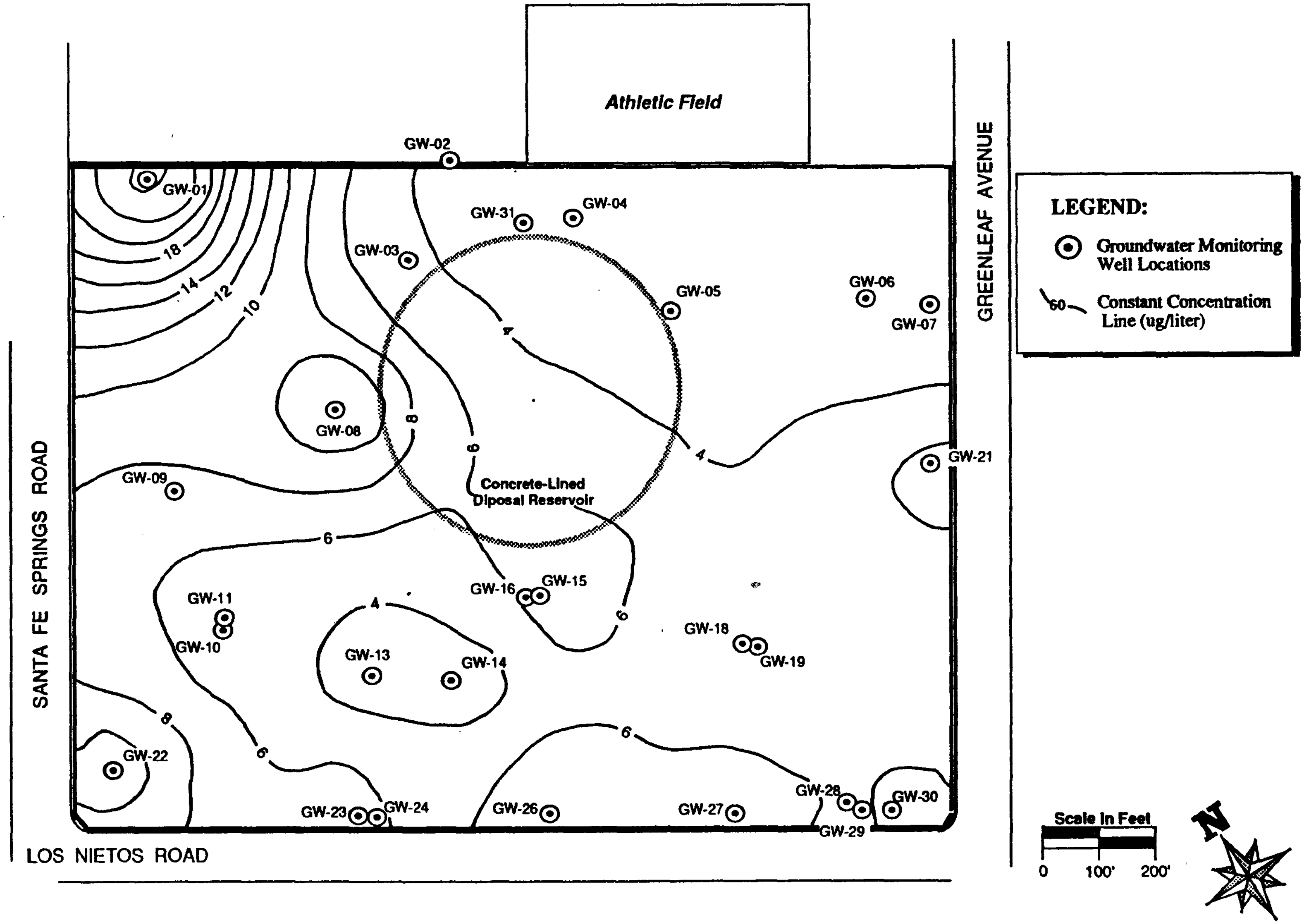
** Refer to Tables 4-4 and 4-5 to determine the primary and secondary MCL standards.

Figure 4-3
ALUMINUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



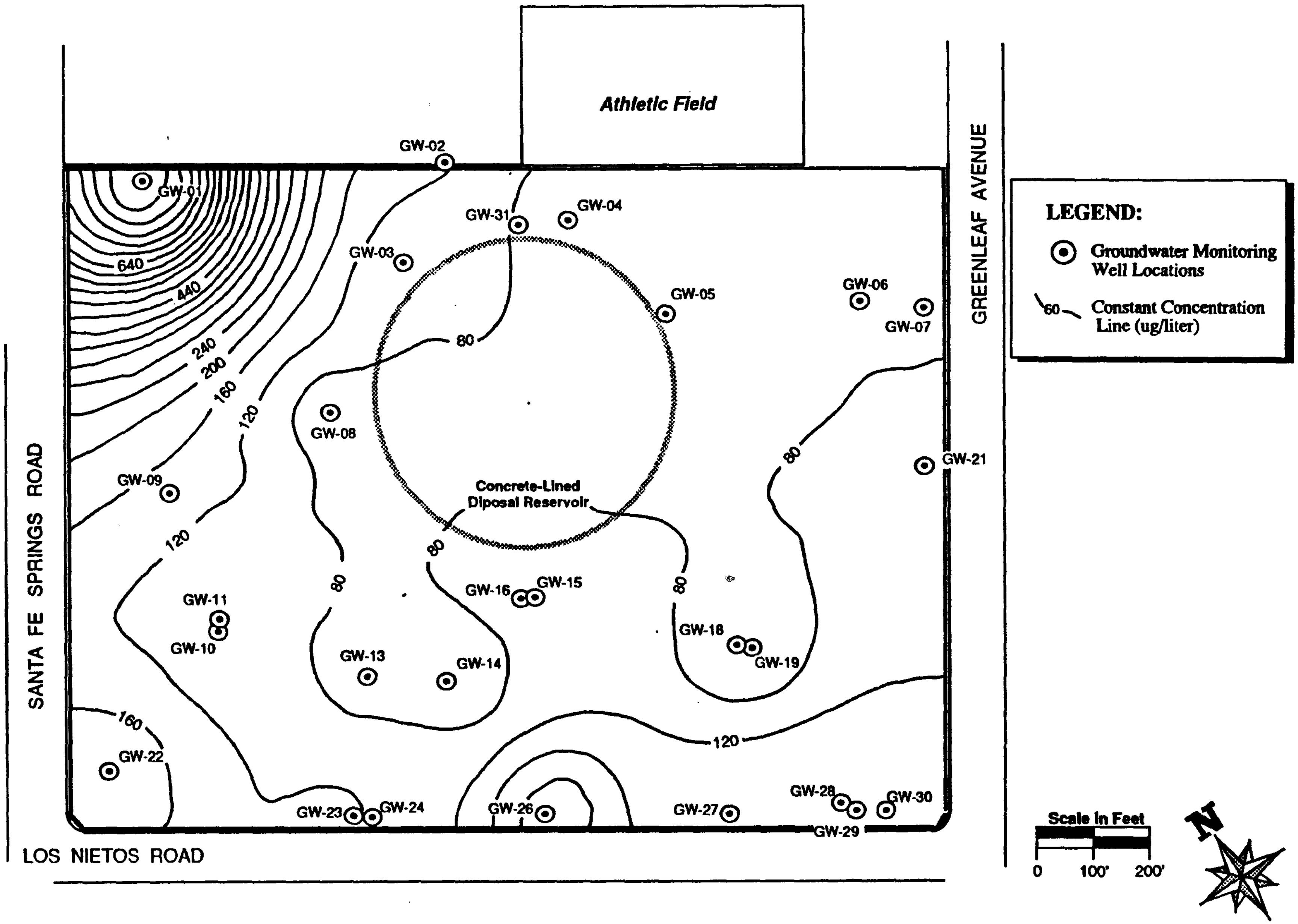
E#15-L(11)

Figure 4-4
ARSENIC CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



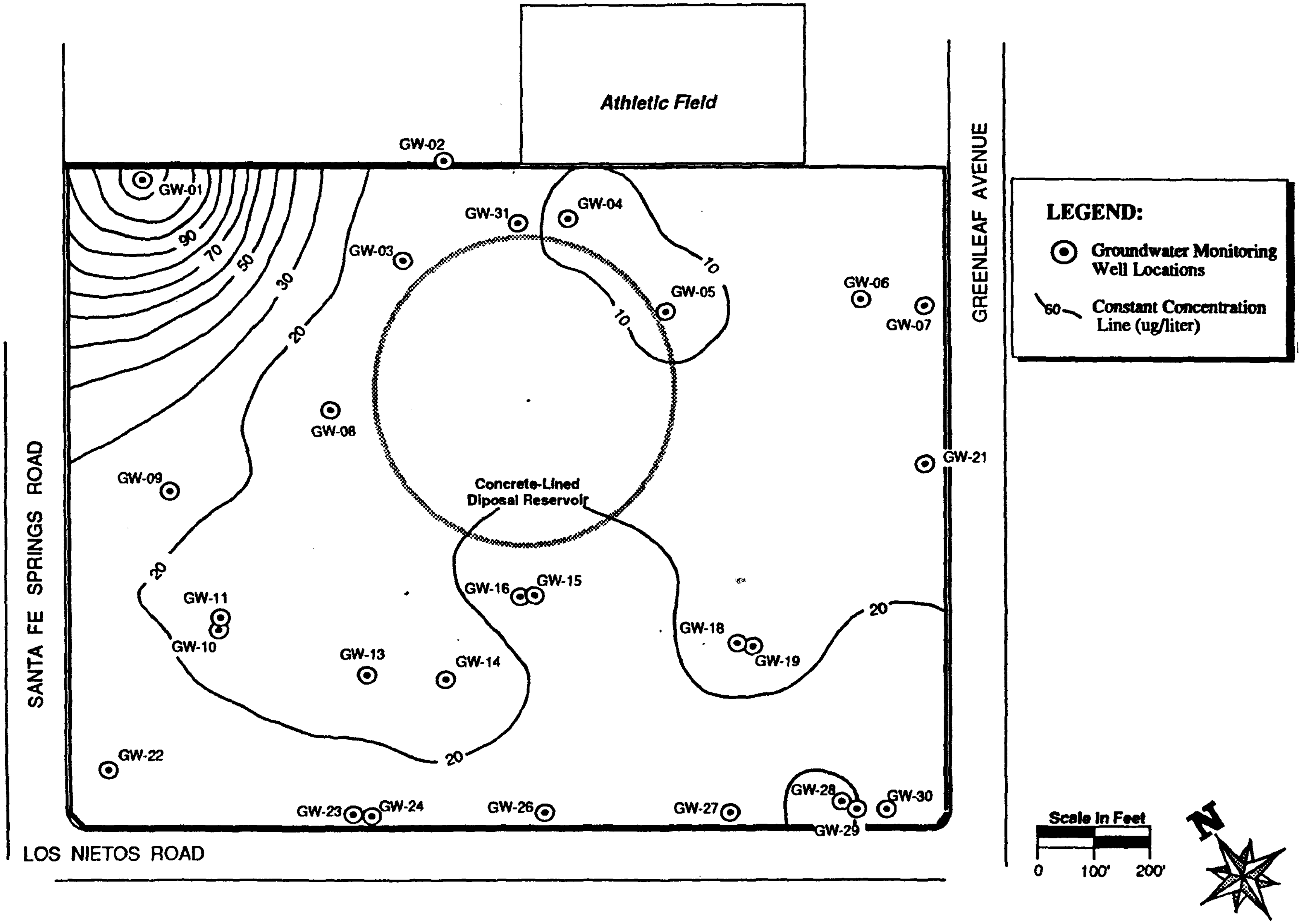
E#15-L(11)

Figure 4-5
BARIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



E#15-L(11)

Figure 4-6
COPPER CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



E#15-L(11)

Figure 4-7
NICKEL CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.

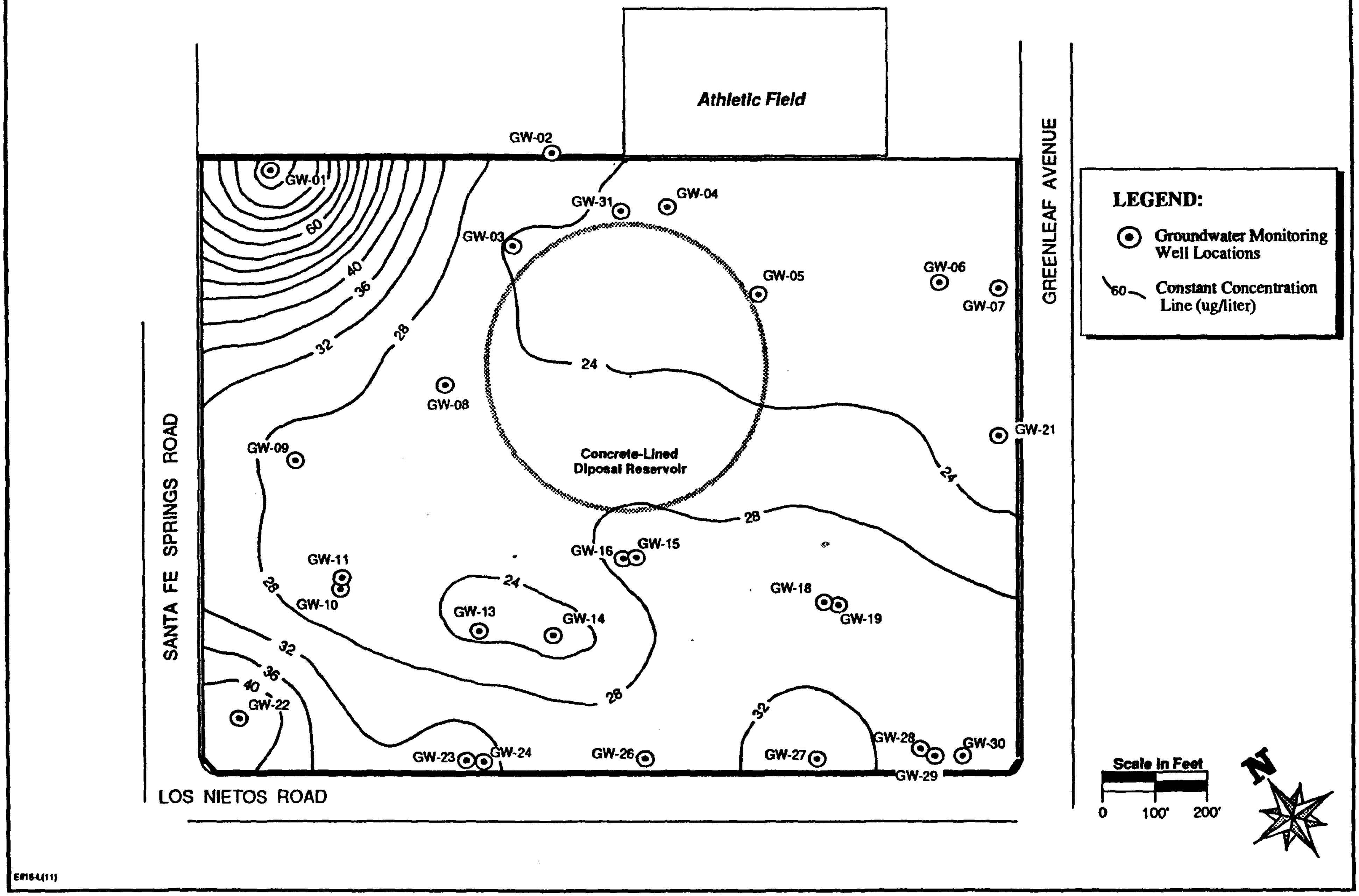
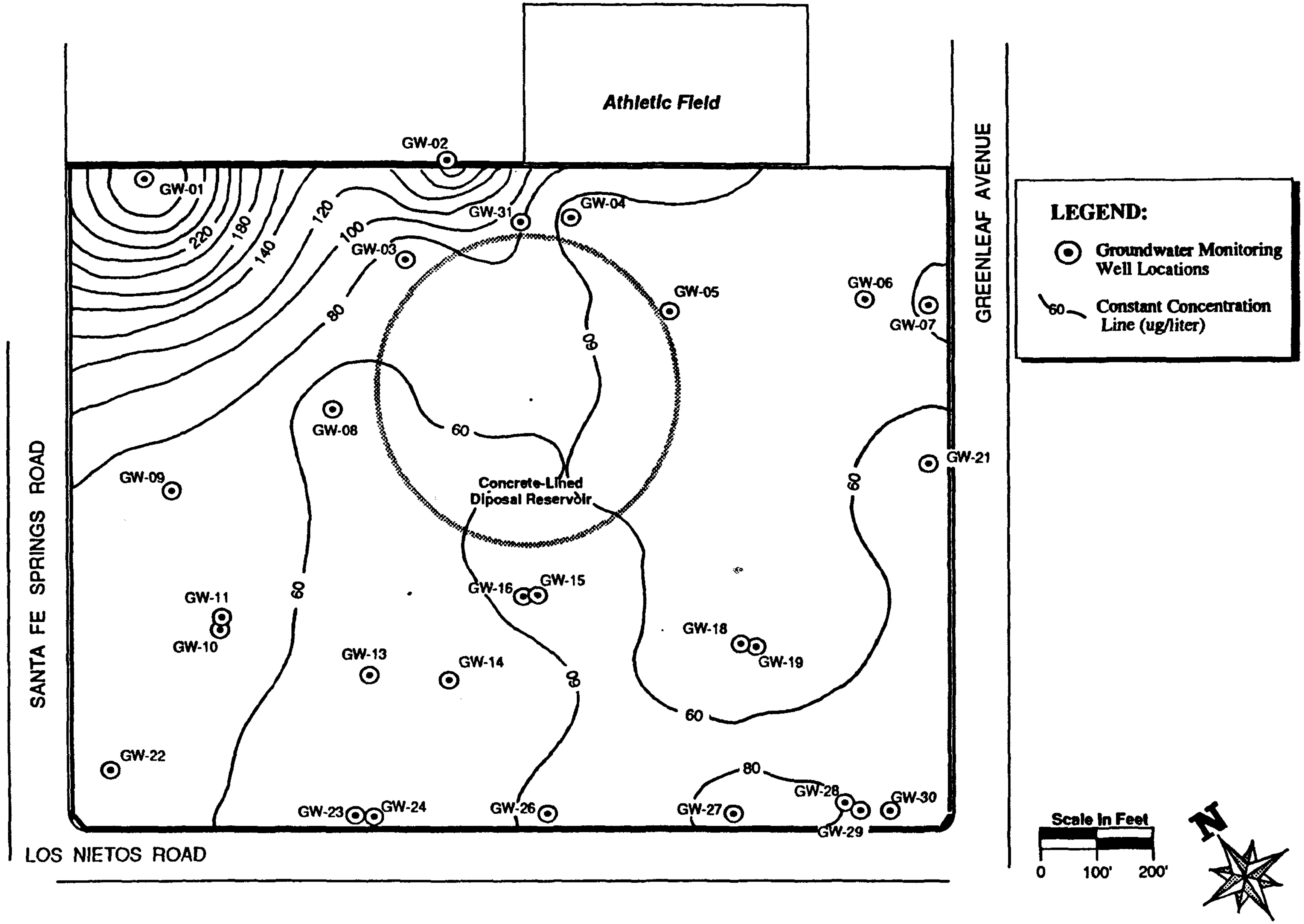
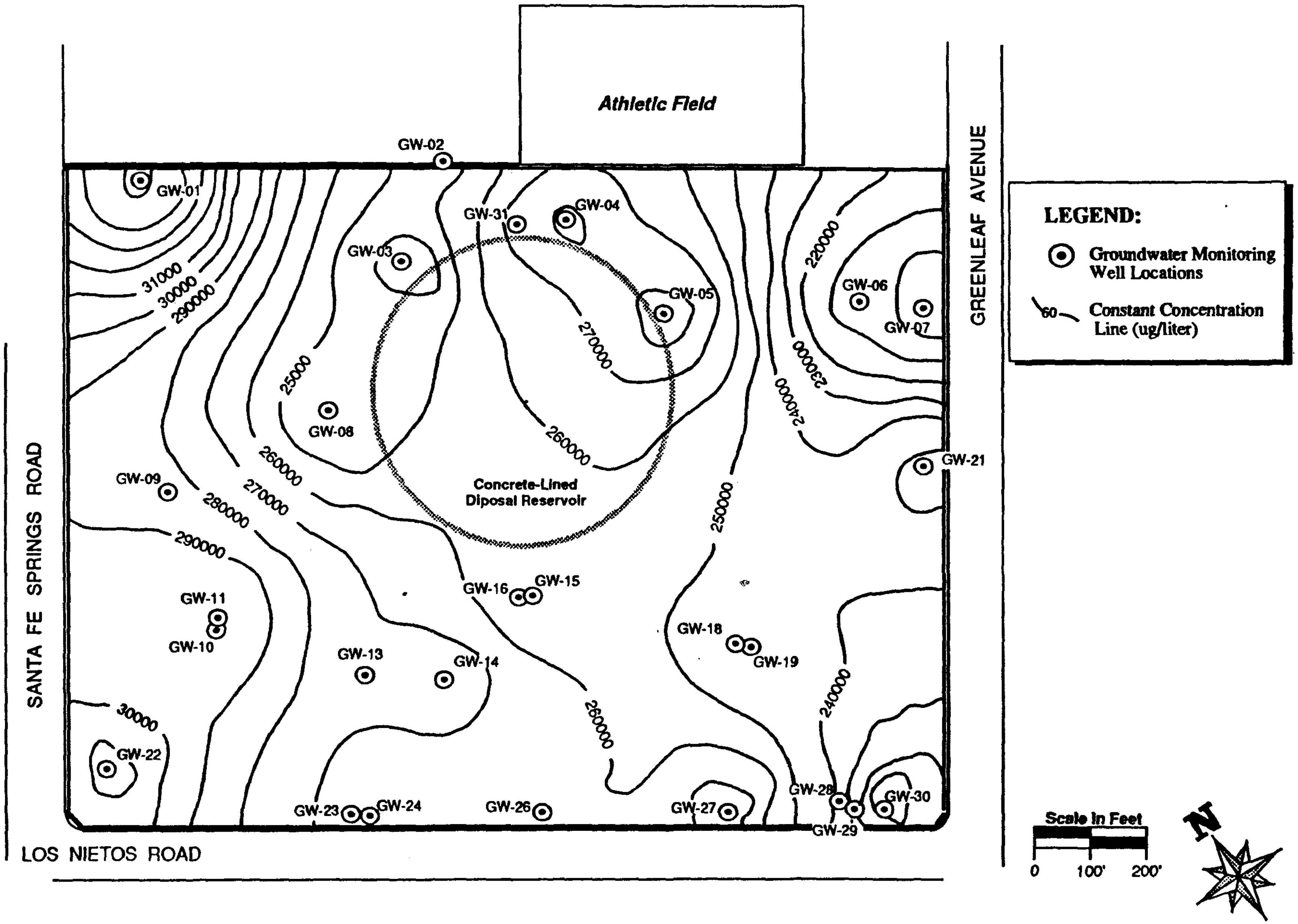


Figure 4-8
ZINC CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



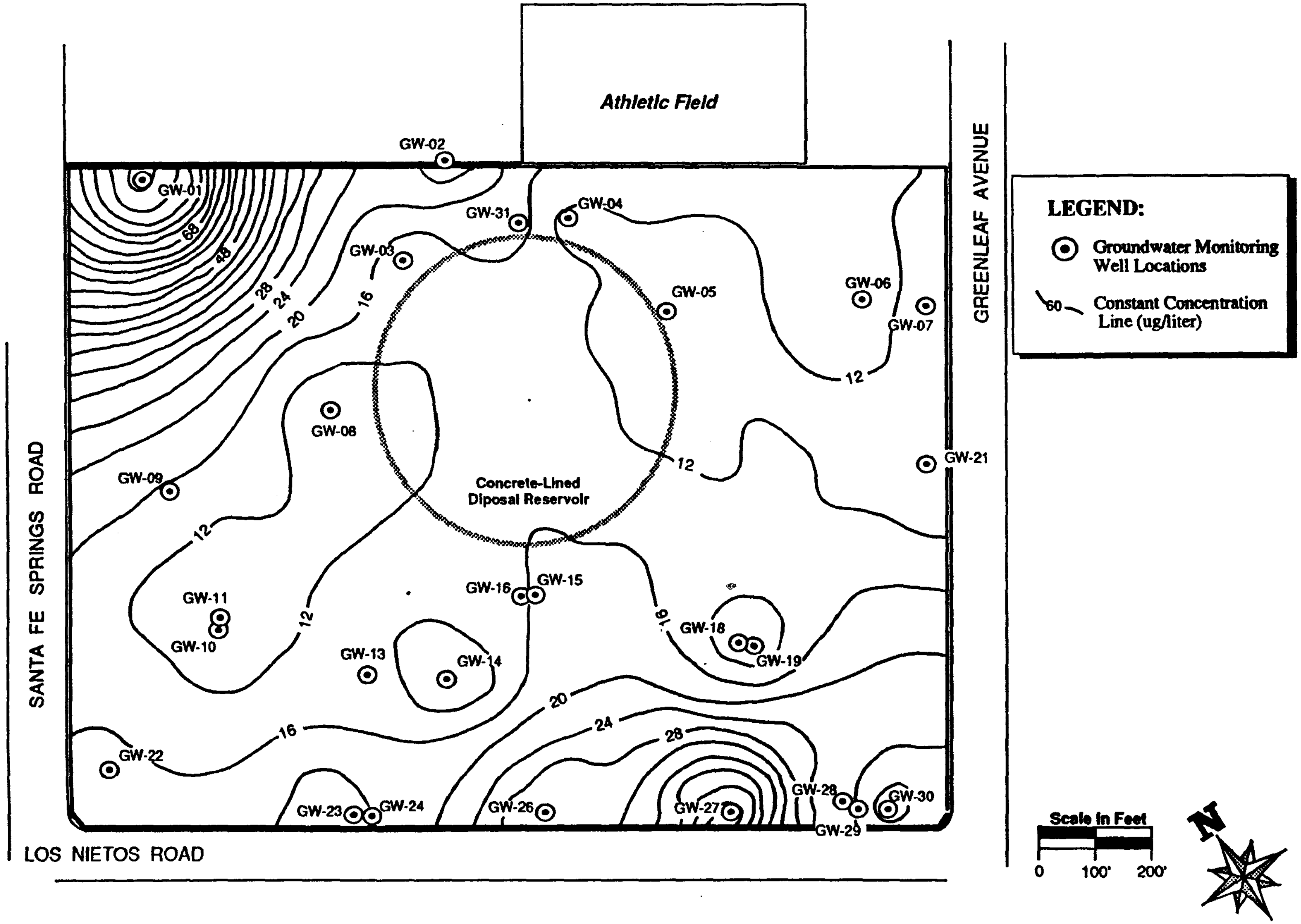
EMS-L(11)

Figure 4-9
CALCIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



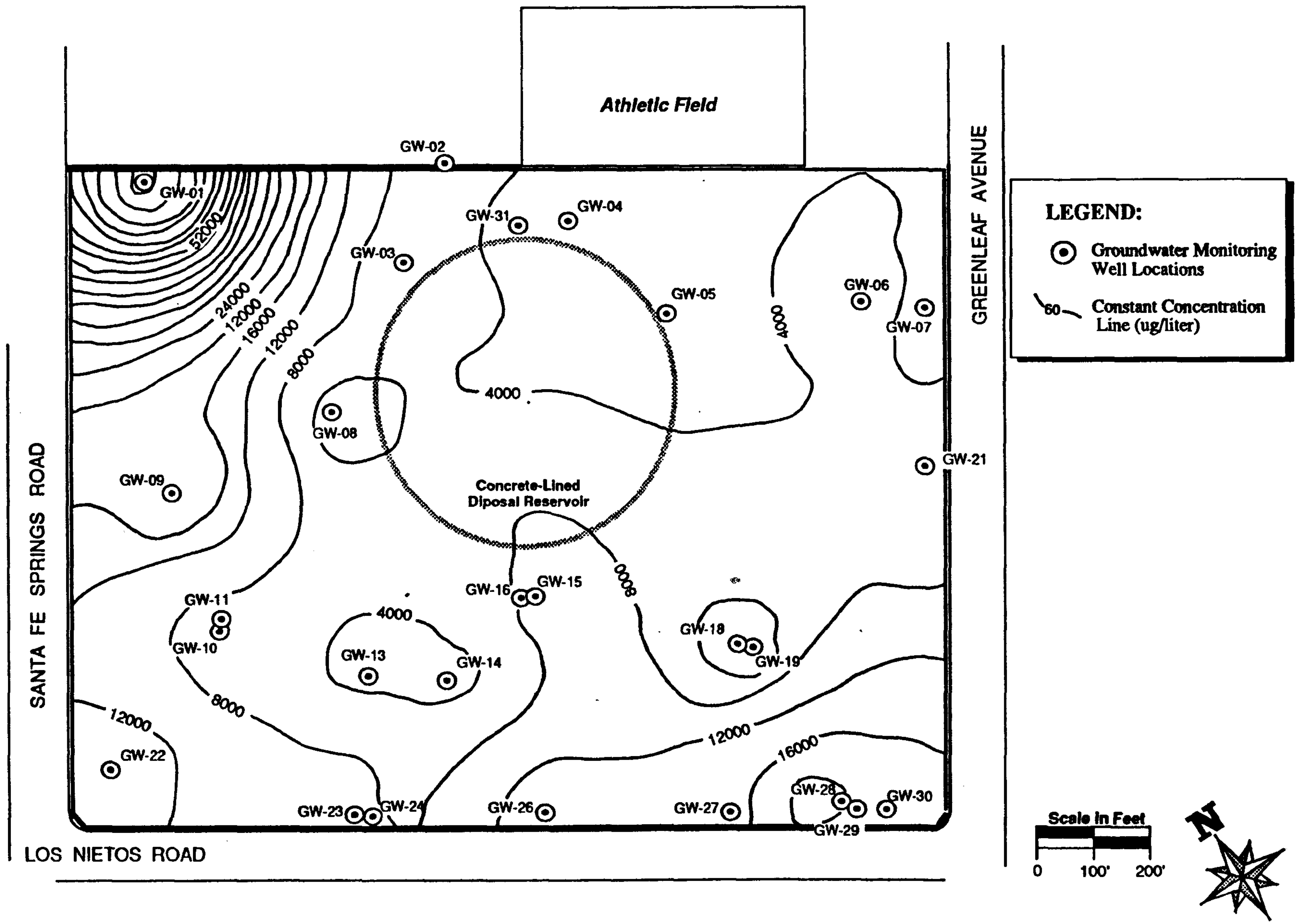
E#15-L(11)

Figure 4-10
CHROMIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



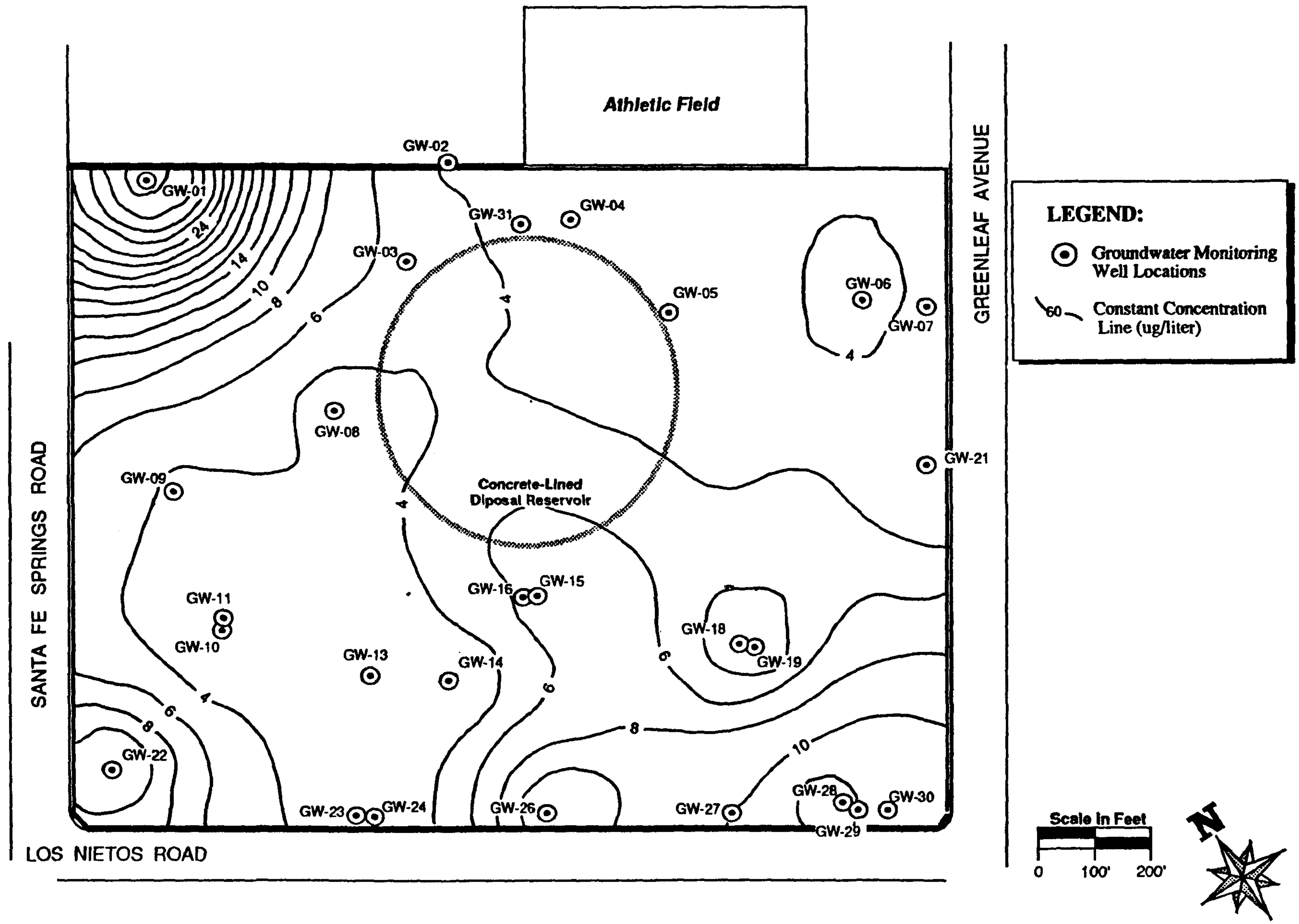
E815-L(11)

Figure 4-11
IRON CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



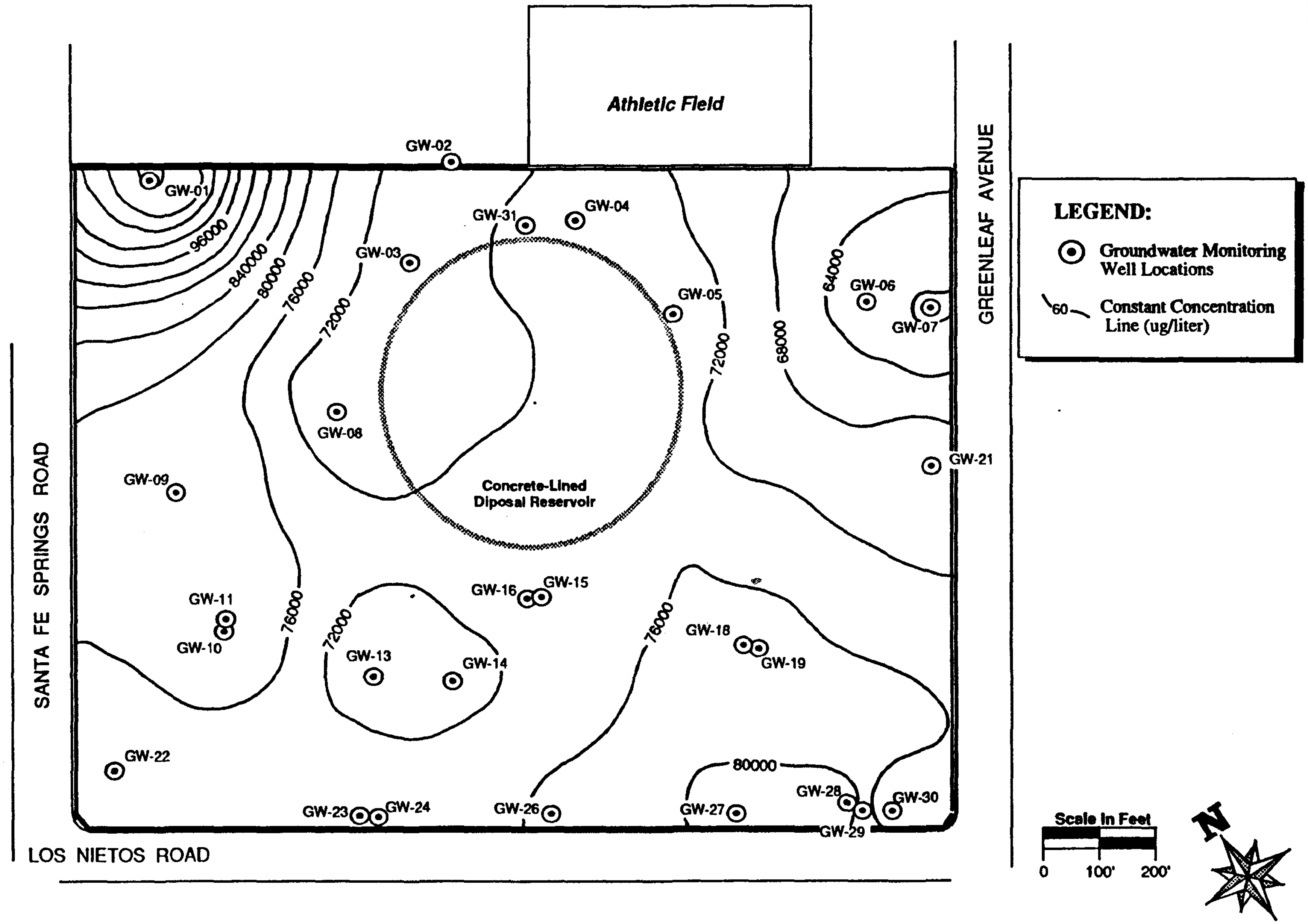
E#15-L(11)

Figure 4-12
LEAD CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



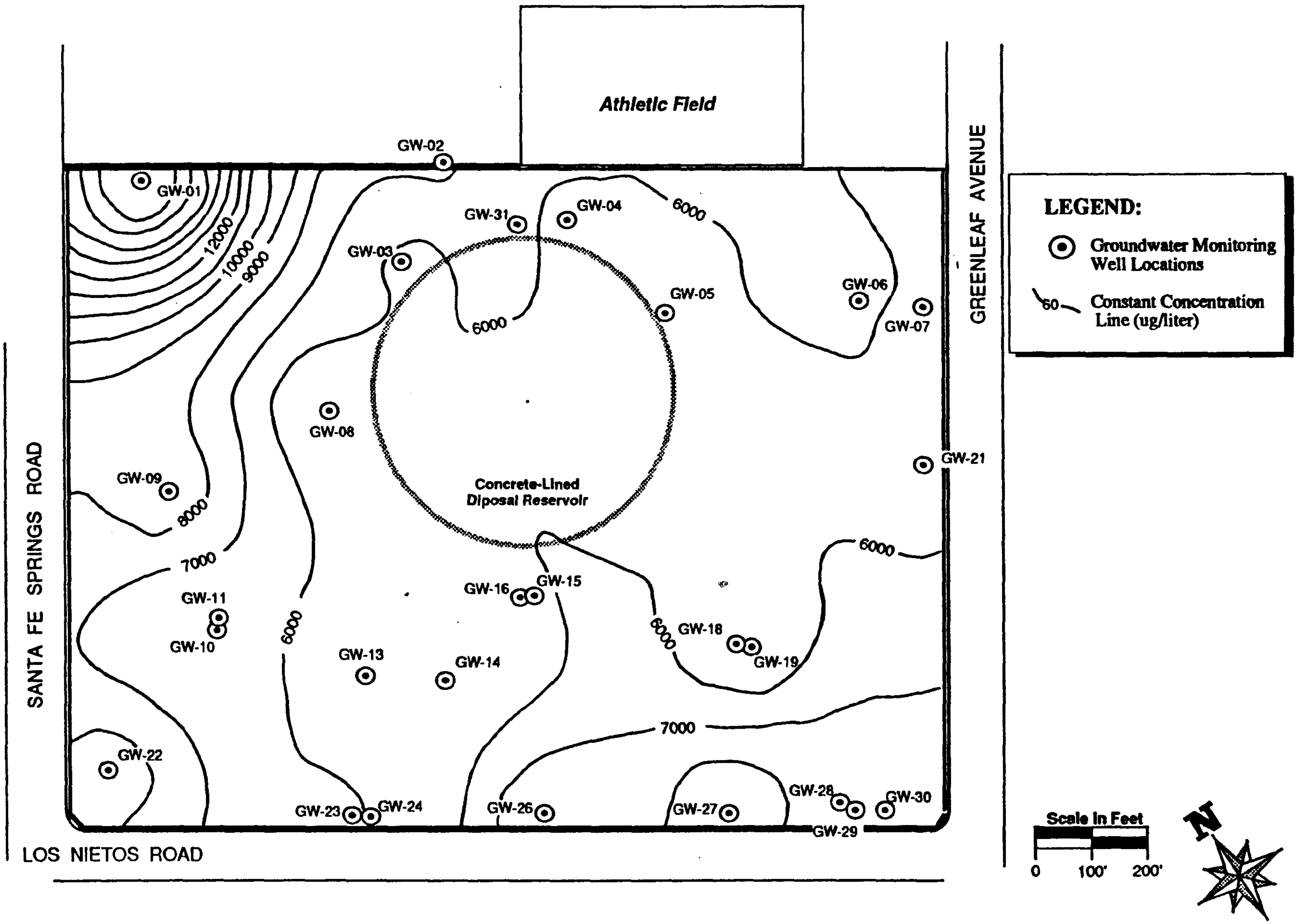
E#15-L(11)

Figure 4-13
MAGNESIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



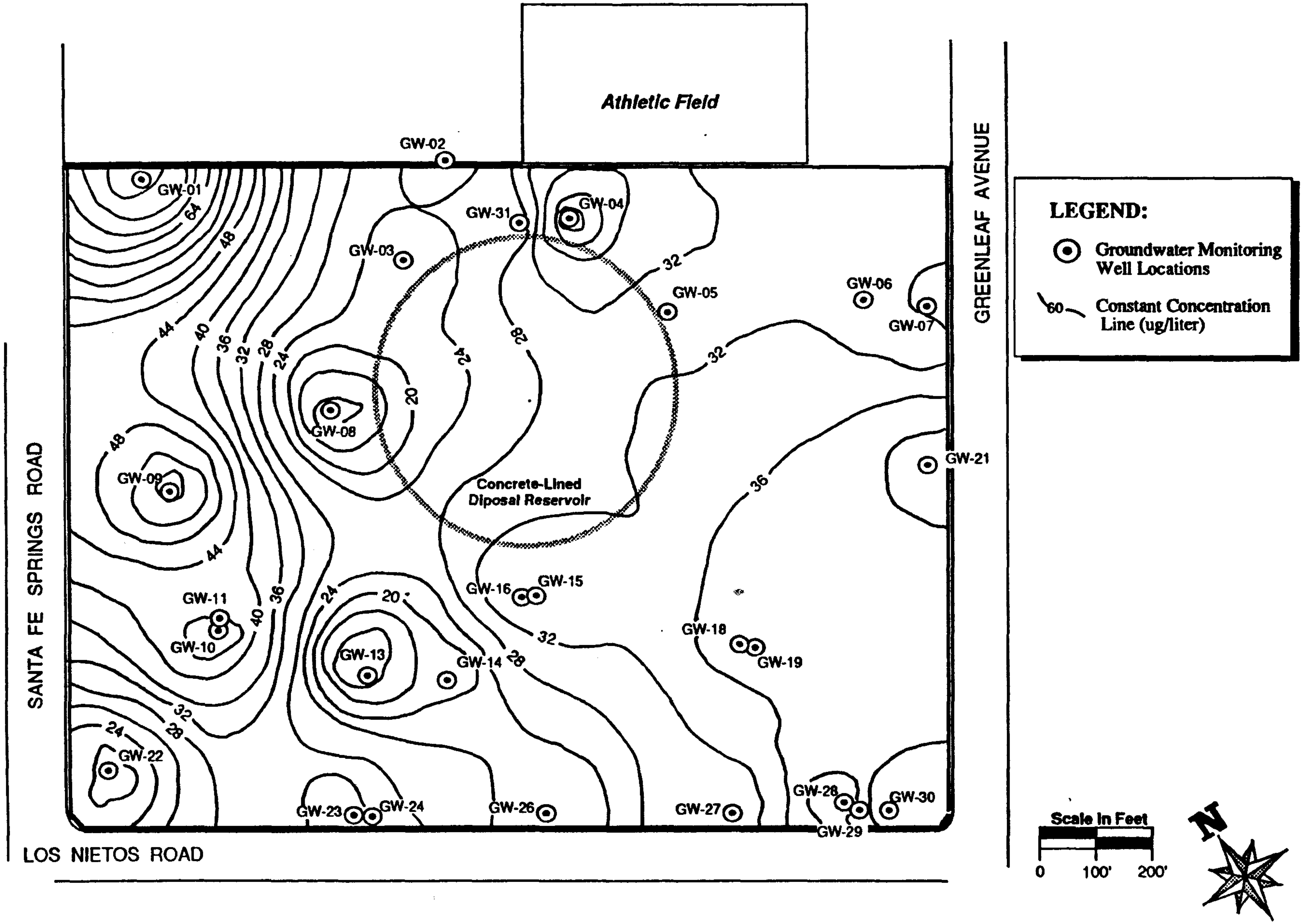
E#15-L(11)

Figure 4-14
POTASIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



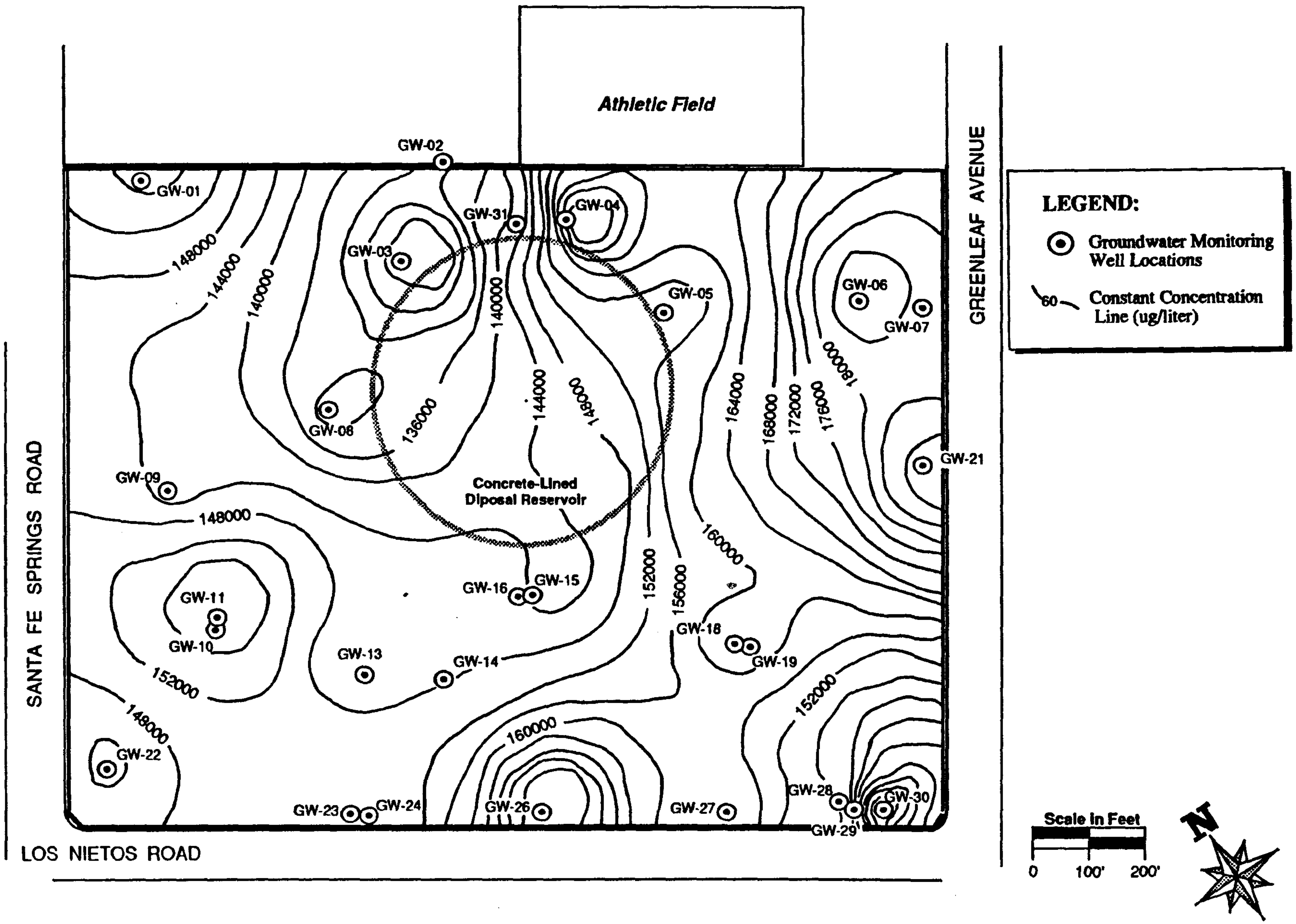
E#15-L(11)

Figure 4-15
SELENIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



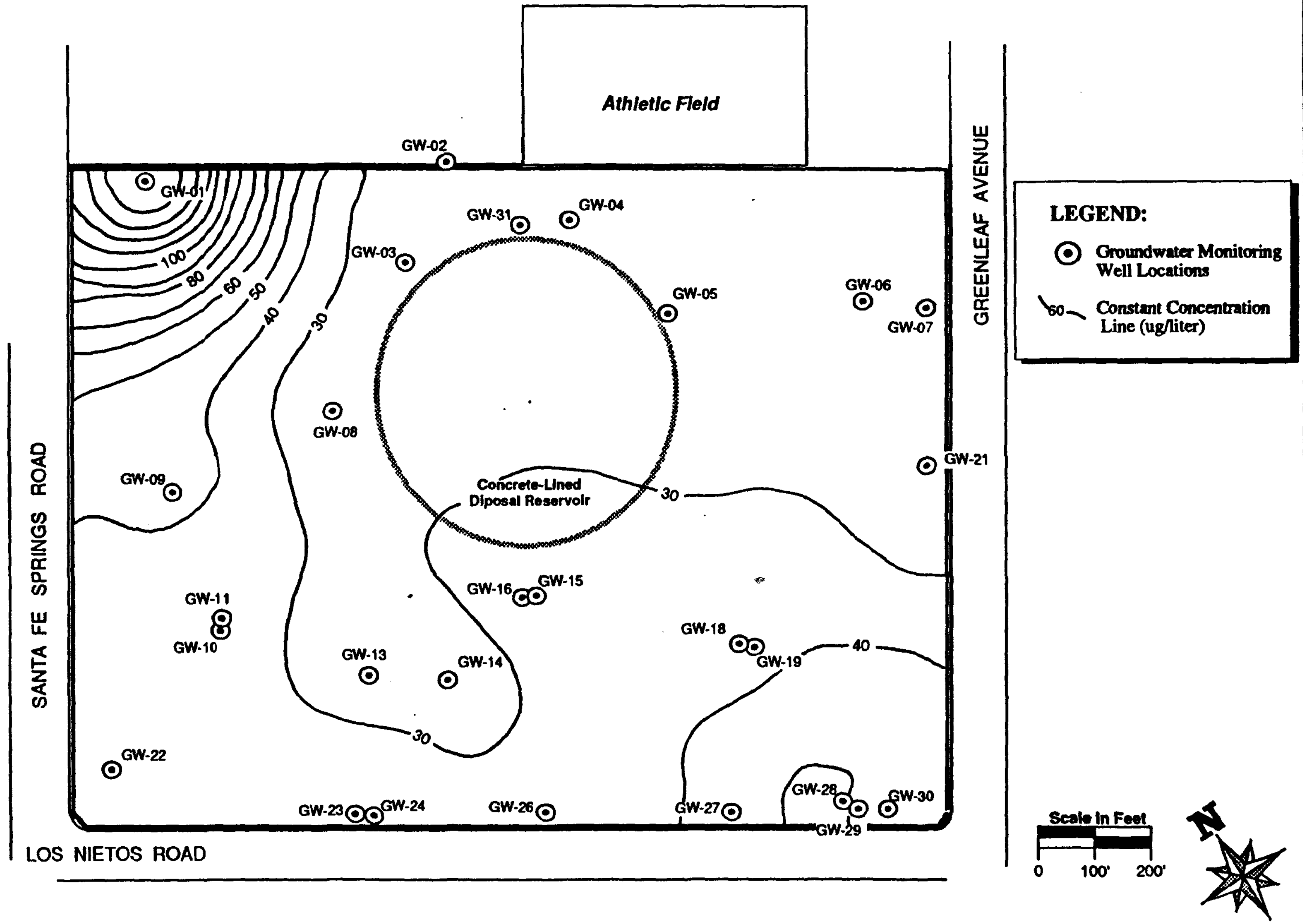
E#15-L(11)

Figure 4-16
SODIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



E#15-L(11)

Figure 4-17
VANADIUM CONCENTRATION IN GROUNDWATER
WASTE DISPOSAL INC.



E816-L(11)

- o Iron was detected in twenty six (26) wells. Concentration of iron exceeds the MCL standard in twenty four (24) of these wells. The range of iron concentration is from 221 to 79,300 ppb. The highest iron concentration was found in GW-01, an upgradient well.

- o Magnesium was found in all wells. Concentration of magnesium ranges from 59 to 114 ppm. Magnesium was detected both upgradient and downgradient from the site.

- o Nickel was found in eleven (11) wells. The nickel concentration ranges from 24 ppb to 79 ppb. The highest concentration was found in GW-01, an upgradient well.

- o Concentrations of manganese were detected at all wells including the two upgradient wells, GW-01 and GW-02. Concentrations above the MCL standard were found in twenty-four (24) wells. Manganese concentration ranged from 20 to 5,850 ppb. The highest concentrations of manganese were found in GW-13, GW-14, GW-15 and GW-21 with concentrations between 4,010 to 5,850 ppb. The first three of those wells are located downgradient of the reservoir.

- o Potassium was detected in all wells. The concentration of potassium ranges from 5,240 to 18,400 ppb. The highest concentration was detected at GW-01, an upgradient well.

- o Concentrations of selenium were detected in twenty six wells. Twenty five wells had concentrations above the MCL. The highest concentration of selenium was detected in GW-01, an upgradient well.

- o Sodium was detected in all wells. Sodium concentration ranges from 102 to 190 ppm. The average sodium concentration for the two upgradient wells is approximately 140 ppm.

- o Vanadium was detected in ten (10) monitoring wells. The highest concentration of vanadium was found in GW-01, an upgradient well.

4.2.2.2 Volatile Organic Compounds

Five volatile organic compounds were detected in WDI groundwater (Table 4-8). However, the concentrations of the contaminants are much lower than SDWA MCLs and California Department of Health Services (DHS) action levels. Trichloroethene is the only volatile organic compound found in a concentration (18 ppb) above the MCL standard (5 ppb) in well GW-26. Acetone, a common laboratory contaminant, was found in GW-30. Concentrations of toluene (1-5 ppb) were detected in nine wells. Tetrachlorethene was found in GW-11 and GW-21. Chloroform was found in the wells GW-06 and GW-07.

4.2.2.3 Semivolatile Organic Compounds

Four semivolatile organic compounds were detected in WDI groundwater (Table 4-9). Bis(2-chloroethyl)ether was detected at well locations GW-06, GW-07, GW-19 and GW-31. The concentration of this compound range from 260 ppb at GW-06 to 690 ppb at GW-19. A concentration of 36 ppb diethylphthalate was detected in GW-05. Concentrations of Di-n-butylphthalate (2 ppb) were found in GW-07 and GW-31. A concentration of 9 ppb of Di-n-octylphthalate was detected at GW-07. All three phthalate compounds are common lab contaminants.

4.2.2.4 Pesticides/PCB Compounds

Pesticides and PCB compounds were not present in detectable concentrations in WDI groundwater samples.

TABLE 4-8

CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER
WDI SITE

	Sample Location	Value (ug/l)	Detect*	Maximum Contaminant Levels
Acetone	GW-030-001	1100.00	J	N/A
Chloroform	GW-006-001	9.00		N/A
	GW-007-001	8.00		N/A
Tetrachloroethene	GW-011-001	11.00		N/A
	GW-021-001	1.00	J	N/A
Toluene	GW-006-001	2.00	J	100 ppb
	GW-007-001	1.00	J	100 ppb
	GW-008-001	4.00	J	100 ppb
	GW-010-001	3.00	J	100 ppb
	GW-015-001	5.00	J	100 ppb
	GW-019-001	1.00	J	100 ppb
	GW-019-002	4.00	J	100 ppb
	GW-022-001	5.00		100 ppb
	GW-026-001	4.00	J	100 ppb
	GW-031-001	2.00	J	100 ppb
Trichloroethene	GW-026-001	18.00		5 ppb

* Values are estimated, data is valid for <u>limited</u> purposes. The result are qualitatively acceptable unless otherwise noted.

N/A - Not Available.

TABLE 4-9

CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS
IN GROUNDWATER
WDI SITE

	Sample Location	Value	Detect*	Maximum Contaminant Levels
Di-n-butylphthalate	GW-007-001	2.00	J	N/A
	GW-031-001	2.00	J	N/A
Di-n-octylphthalate	GW-007-001	9.00	J	N/A
Diethylphthalate	GW-005-001	36.00		N/A
bis(2-Chloroethyl)ether	GW-006-00	260.00		N/A
	GW-007-001	590.00	J	N/A
	GW-019-001	690.00	J	N/A
	GW-019-002	240.00		N/A
	GW-031-001	280.00		N/A

* Values are estimated, data is valid for limited purposes. The result are qualitatively acceptable unless otherwise noted.

N/A - Not Available.

5.0 SUMMARY AND RECOMMENDATIONS

5.1 NATURE AND EXTENT OF CONTAMINATION

The results of chemical analyses of groundwater samples from WDI indicate that metals are the most widespread of contaminants. Metals were detected both upgradient and downgradient of the WDI reservoir. Highest concentrations of metals were found in the upgradient wells.

Other findings of the groundwater characterization study are shown in Table 5-1. They include:

- Monitoring well GW-26 was the only well that showed contamination by tricholoroethene above the MCL standards. None of the other monitoring wells showed any contamination by volatile organics.

- Bis (2-chloroethyl) ether was the only semivolatile organic compound that was detected at more than one well but it was not found consistently throughout the site.

- Pesticides and PCB compounds were not detected in any of the monitoring wells.

- Aluminum, iron, manganese and selenium were found in concentrations exceeding the MCL standards in almost all wells. Both upgradient and downgradient wells showed high concentrations of these metals.

5.2 RECOMMENDATIONS FOR FUTURE WORK

Overall, the present network of groundwater monitoring wells defines the direction of groundwater flow and identifies the nature and extent of groundwater contamination at WDI. Several recommendations for future work which would improve characterization of the physical and chemical characteristics of WDI groundwater include:

TABLE 5-1

SUMMARY OF WDI GROUNDWATER CONTAMINATION

GW-Well	Location [a]	NUMBER OF CONTAMINANTS Metals	Volatiles	Semivolatiles	Pesticides/PCBs
GW-01	B&L (NW of Reservoir)	18	-	-	-
GW-02	Fedco(NW of Reservoir)	15	-	-	-
GW-03	RV Storage (W of Reservoir)	15	-	-	-
GW-04	Reservoir	12	-	-	-
GW-05	Reservoir	12	-	1	-
GW-06	Reservoir	14	2	1	-
GW-07	Reservoir	12	2	3	-
GW-08	RV Storage (NW of Reservoir	15	1	-	-
GW-09	Mersit's Equipment (NW of Reservoir)	18	-	-	-
GW-10	Dia-Log (N of Reservoir)	15	1	-	-
GW-11	Dia-Log (W of Reservoir	10	1	-	-
GW-13	Toxo Spray Dust (SW of Reservoir)	12	-	-	-
GW-14	Terry Trucking (SW of Reservoir)	11	-	-	-
GW-15	H&H Contractors (SW of Reservoir)	16	1	-	-
GW-16	Reservoir (SW of Reservoir)	10	-	-	-
GW-18	Reservoir (SW of Reservoir)	8	-	-	-
GW-19	H&H Contractors (SW of Reservoir)	16	1	1	-
GW-21	Atlas Heat Treating (SE of Reservoir)	14	1	-	-
GW-22	Dia-Log (W of Reservoir)	16	1	-	-
GW-23	Toxo Spray Dust (SW of Reservoir)	18	-	-	-
GW-24	Toxo Spray Dust (SW of Reservoir)	8	-	-	-
GW-26	Timmons Wood	17	2	-	-
GW-27	Rick's Smog (S of Reservoir)	16	-	-	-
GW-28	Campbell Property (S of Reservoir)	16	-	-	-
GW-29	Campbell Property (S of Reservoir)	11	-	-	-
GW-30	Campbell Property (S of Reservoir)	15	1	-	-
GW-31	Reservoir	13	1	2	-

[a] The direction of groundwater flow is toward the southwest.

3682E

- In accordance with EPA's policy, groundwater samples for metals were not filtered. However, if filtered samples were collected and analyzed for metals, the results could be used to confirm the concentration of metals in groundwater which is of health risk concern.

- A new set of groundwater samples collected from GW-01 may be needed to determine if the types and concentrations of metals detected in the original samples from this well are really present or an anamoly. This is importance since the concentration of metals in this well are consistently the highest on the site.

- Monitoring wells should be pumped periodically to remove fine sediment particles that may accumulate in the wells making them ineffective for future sampling and monitoring.

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APPENDIX A

GROUNDWATER-MONITORING-WELL INSTALLATION REPORTS

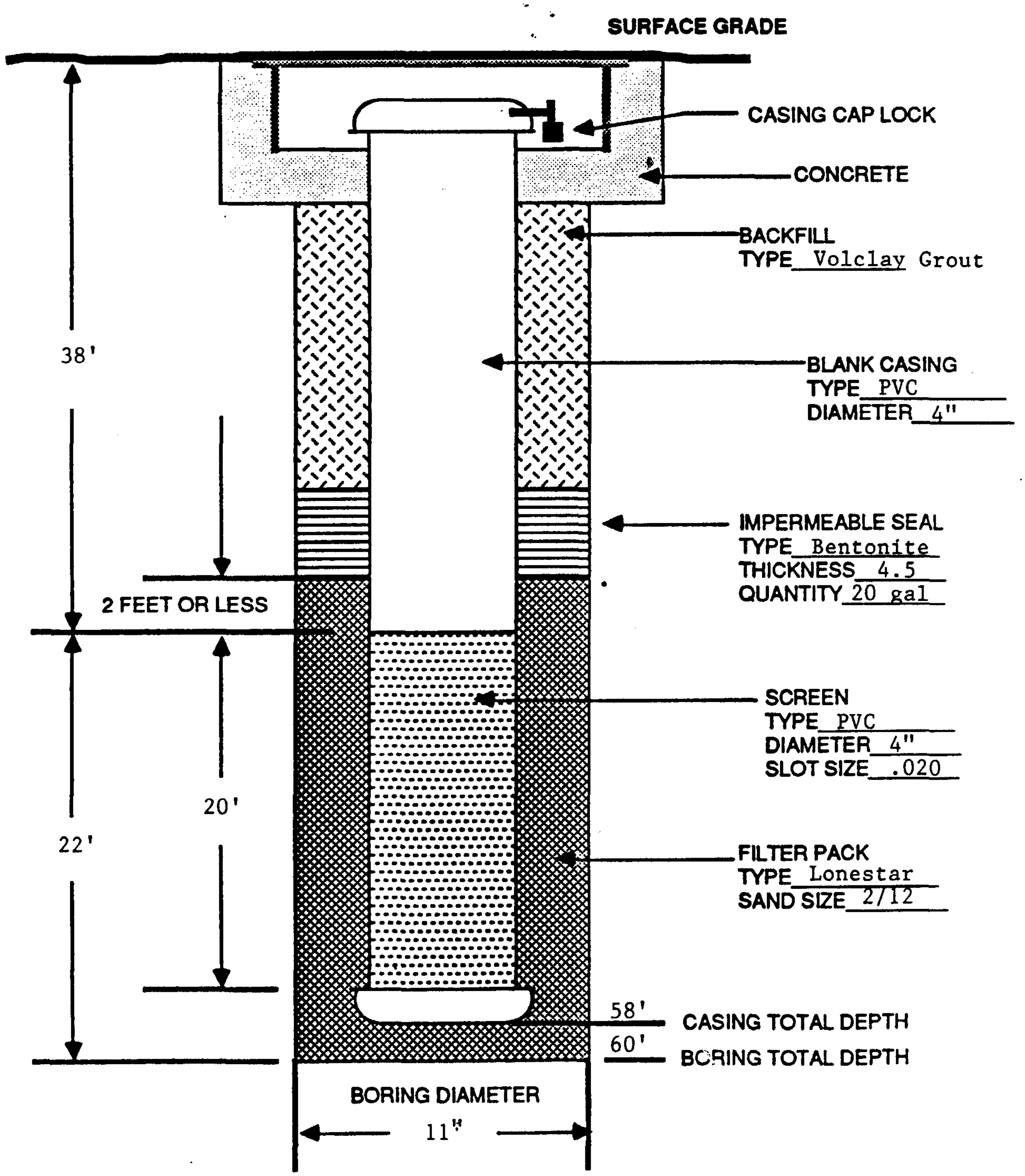
EBASCO SERVICES INCORPORATED EBASCO
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-008/GW-01
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION SubCONTRACTOR: Datum

INSTALLATION DATE: 9/16/88
SURFACE ELEV: (FT ABOVE MSL) 149.6
TOP OF CASING: (FT ABOVE MSL) 149.3
SURVEYED WELL LOCATION: B & L Engineering
SITE MANAGER: R. Jenkins



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3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-005/GW-02

PROJECT NAME: Waste Disposal, Inc.

ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW

INSTALLATION Sub CONTRACTOR: Datum

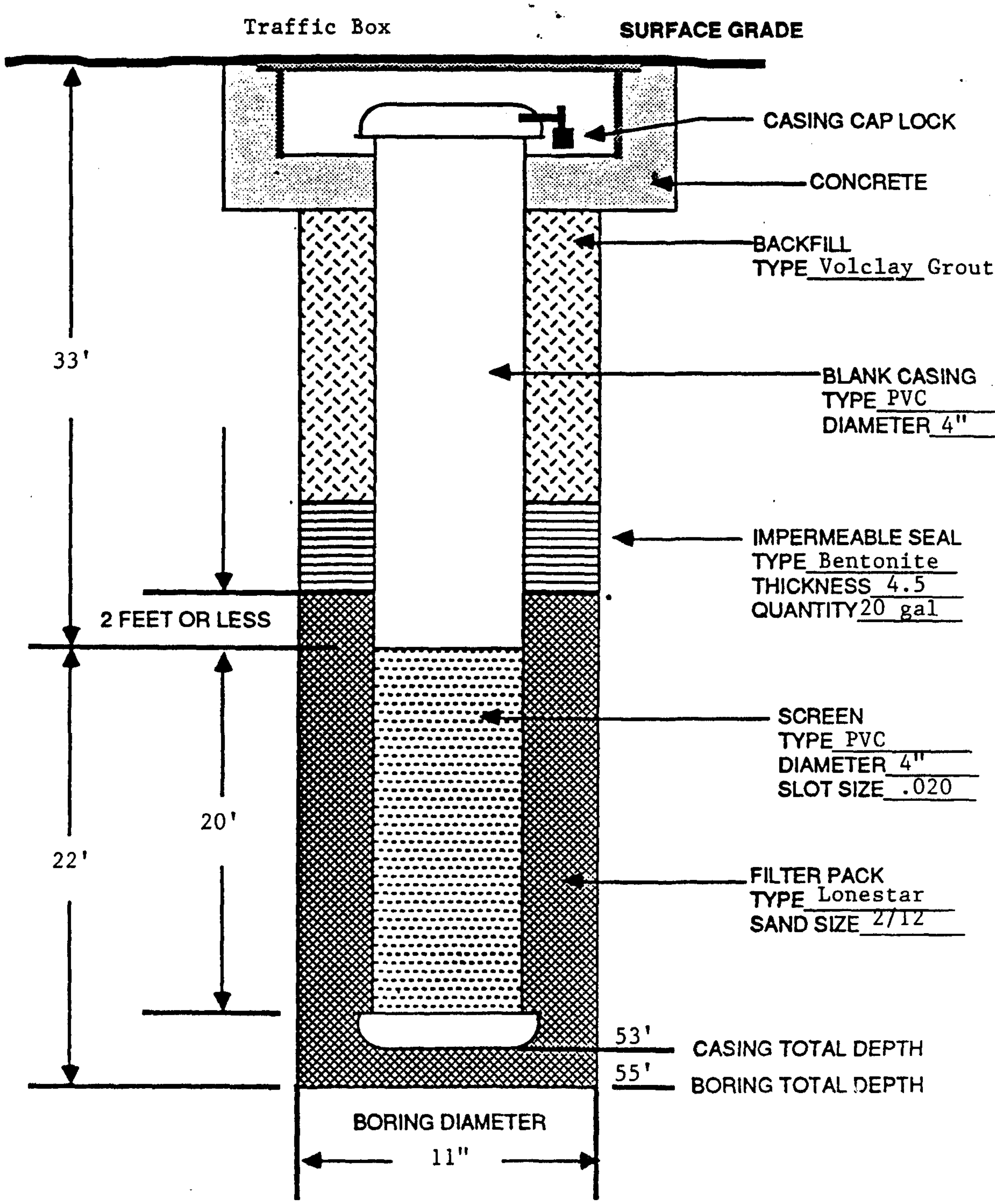
INSTALLATION DATE: 9/15/88

SURFACE ELEV: (FT ABOVE MSL) 153.8

TOP OF CASING: (FT ABOVE MSL) 153.5

SURVEYED WELL LOCATION: Fedco

SITE MANAGER: R. Jenkins



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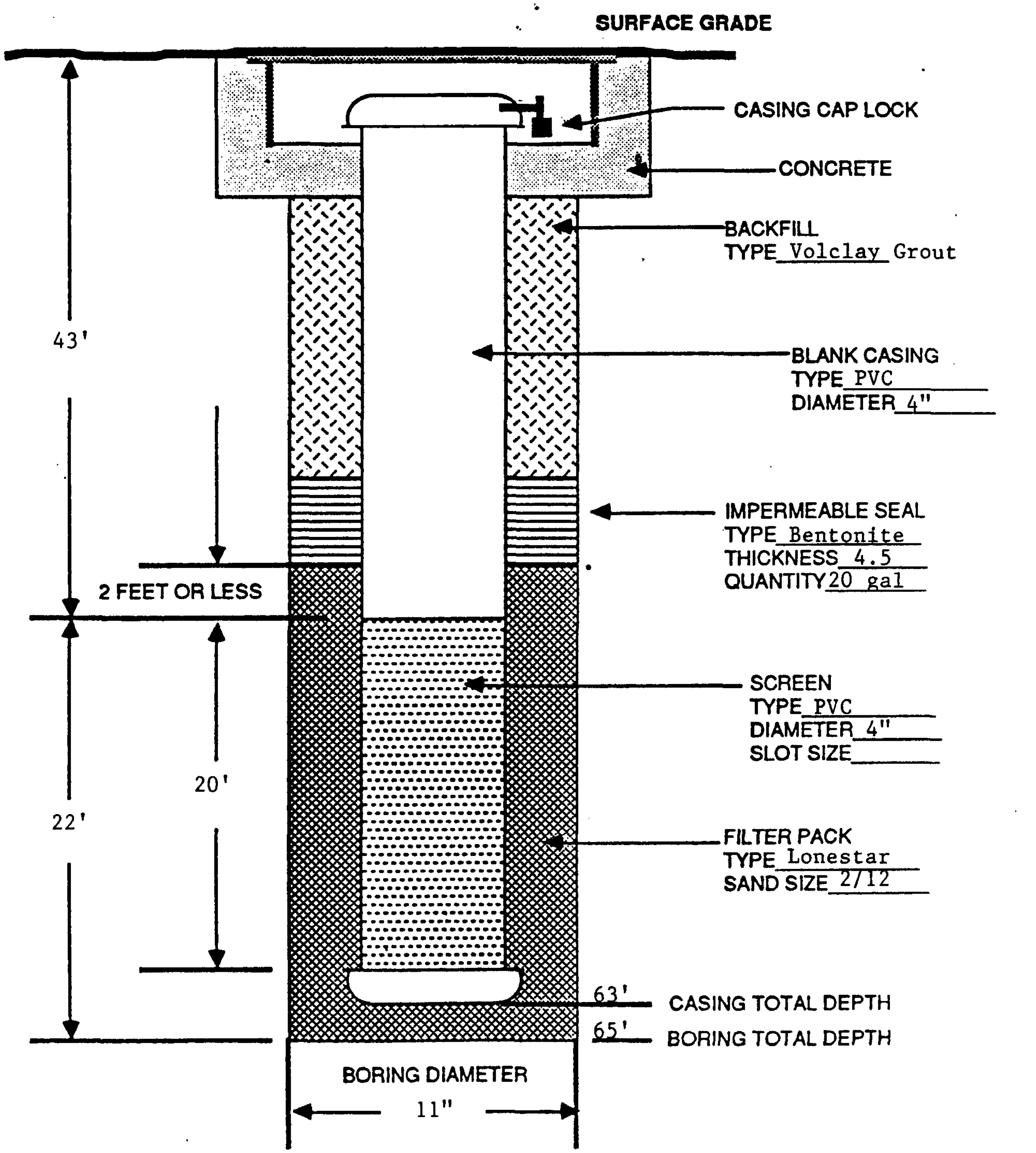
MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-016/GW-31
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/3/88
SURFACE ELEV: 167.5
(FT ABOVE MSL)
TOP OF CASING: 167.2
(FT ABOVE MSL)
SURVEYED
WELL LOCATION: Reservoir Area
SITE MANAGER: R. Jenkins



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MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-017/GW-04

PROJECT NAME: Waste Disposal, Inc.

ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW

INSTALLATION Sub CONTRACTOR: Datum

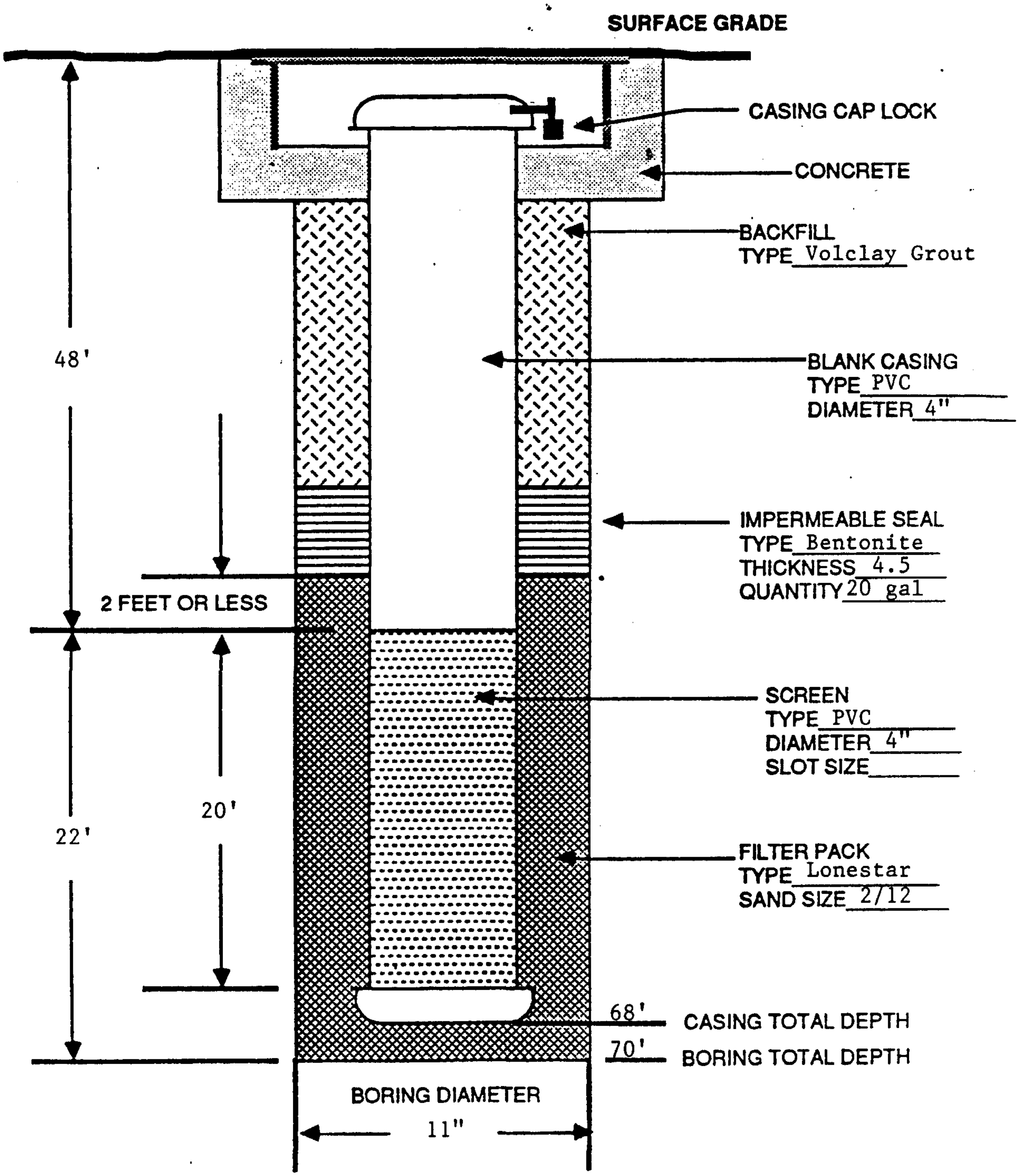
INSTALLATION DATE: 9/26/88

SURFACE ELEV: (FT ABOVE MSL) 167.0

TOP OF CASING: (FT ABOVE MSL) 166.7

SURVEYED WELL LOCATION: Reservoir Area

SITE MANAGER: R. Jenkins



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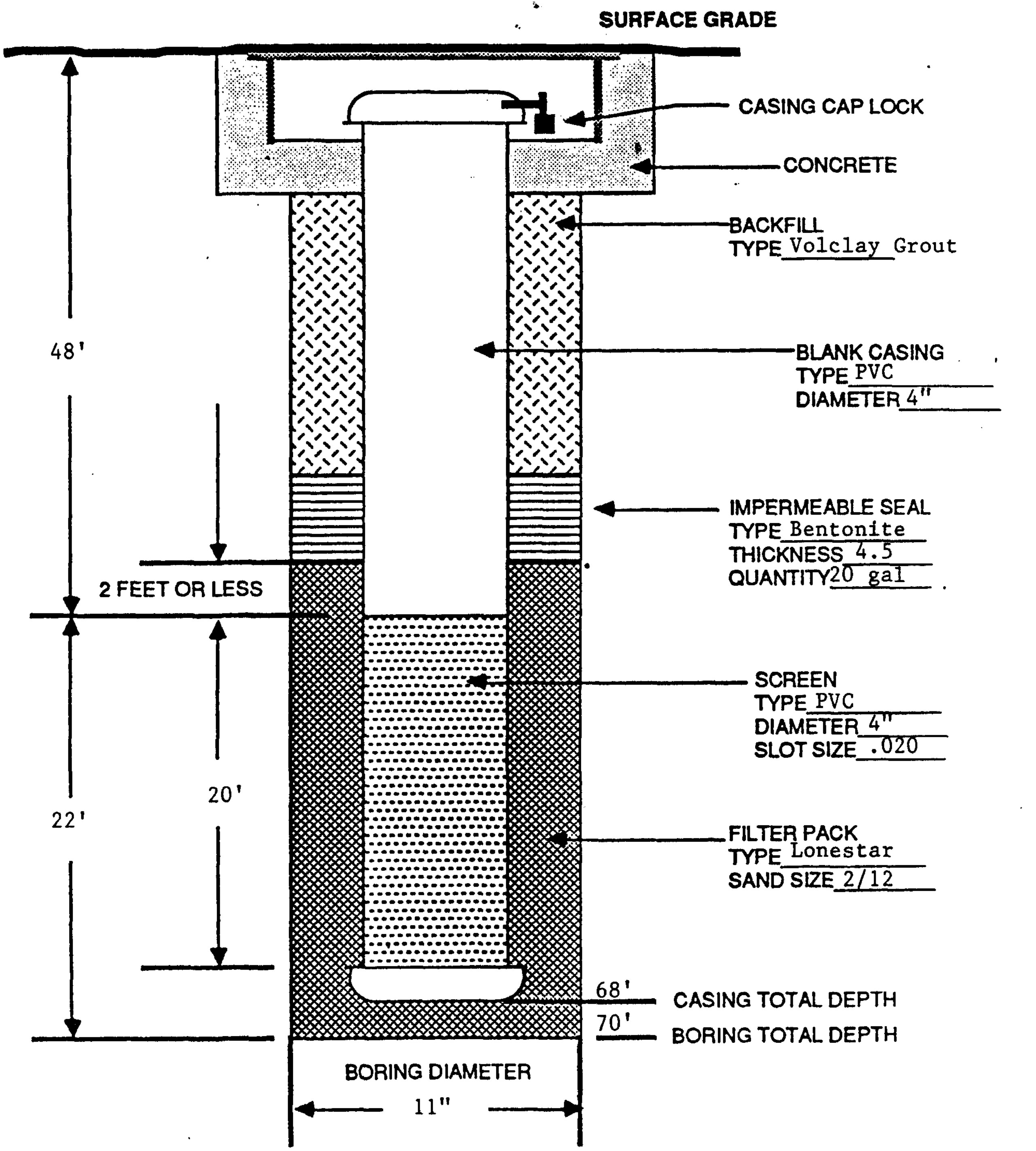
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-026/GW-03
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GMW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/19/88
SURFACE ELEV: 167.8
(FT ABOVE MSL)
TOP OF CASING: 167.5
(FT ABOVE MSL)
SURVEYED
WELL LOCATION: RV Storage
SITE MANAGER: R. Jenkins



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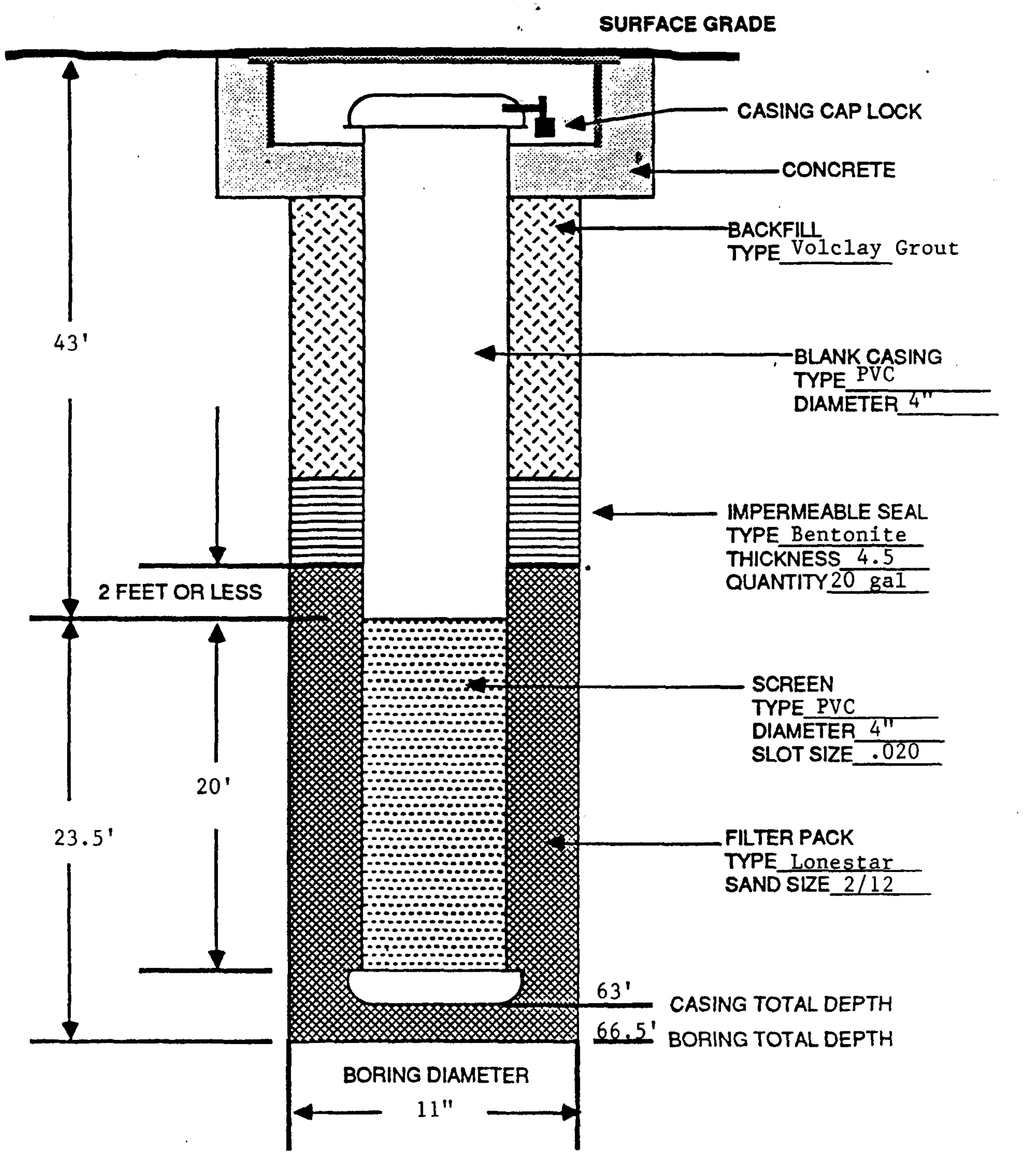
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-029/GW-06	INSTALLATION DATE:	9/9/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	158.6
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	158.3
TYPE OF WELL:	GW	SURVEYED	
INSTALLATION Sub CONTRACTOR:	Datum	WELL LOCATION:	Reservoir Area
		SITE MANAGER:	R. Jenkins



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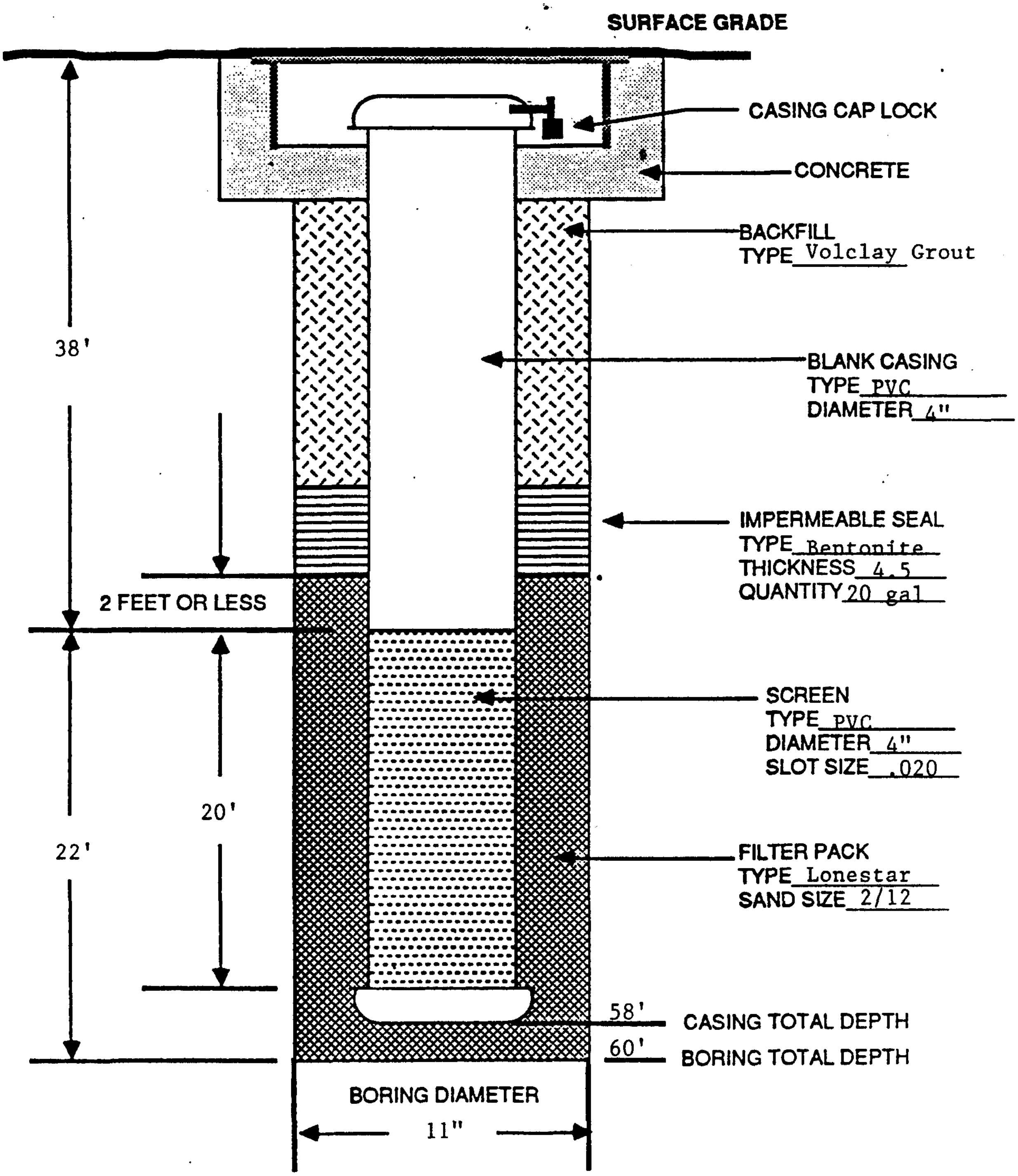
MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB--030/GW-07	INSTALLATION DATE:	9/14/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	154.8
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	154.5
TYPE OF WELL:	GW	SURVEYED	
INSTALLATION Sub CONTRACTOR:	Datum	WELL LOCATION:	Reservoir Area
		SITE MANAGER:	R. Jenkins



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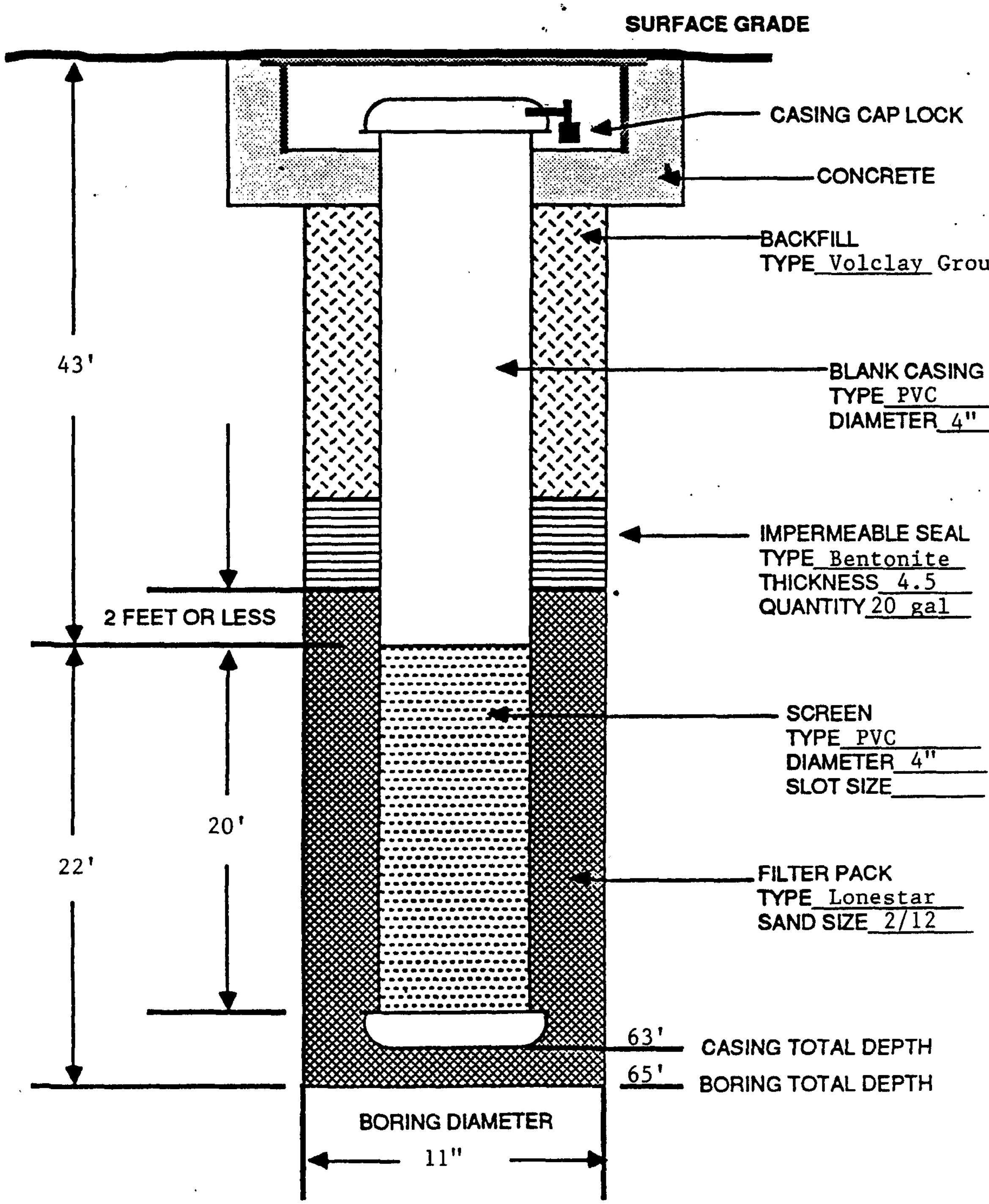
MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-036/GW-05	INSTALLATION DATE:	10/3/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	166.9
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	166.6
TYPE OF WELL:	GMW	SURVEYED	
INSTALLATION Sub CONTRACTOR:	Datum	WELL LOCATION:	Reservoir Area
		SITE MANAGER:	R. Jenkins



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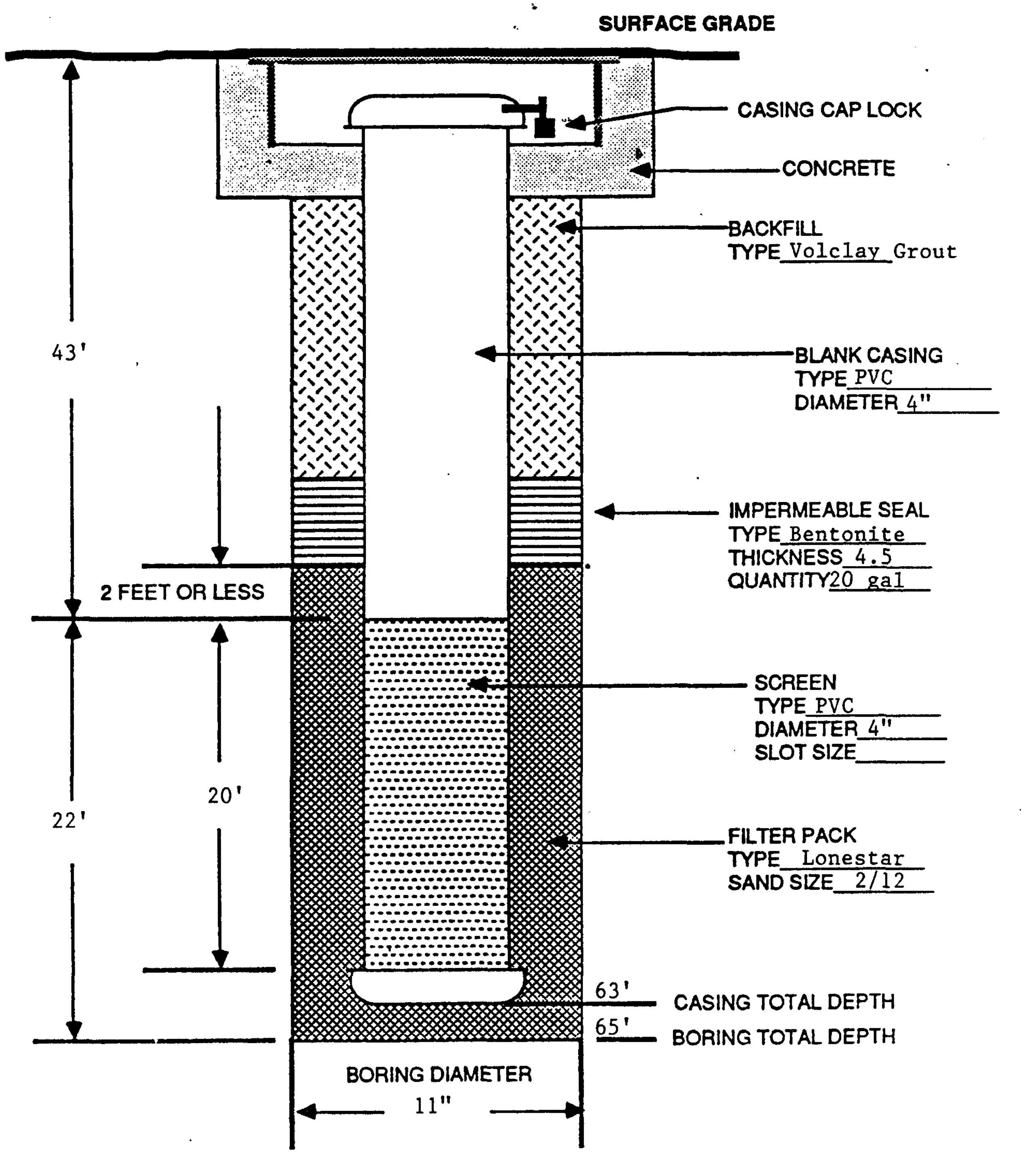
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-046/GW-08	INSTALLATION DATE:	10/19/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	163.6
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	163.3
TYPE OF WELL:	GW	SURVEYED	
INSTALLATION		WELL LOCATION:	RV Storage
Sub CONTRACTOR:	Datum	SITE MANAGER:	R. Jenkins



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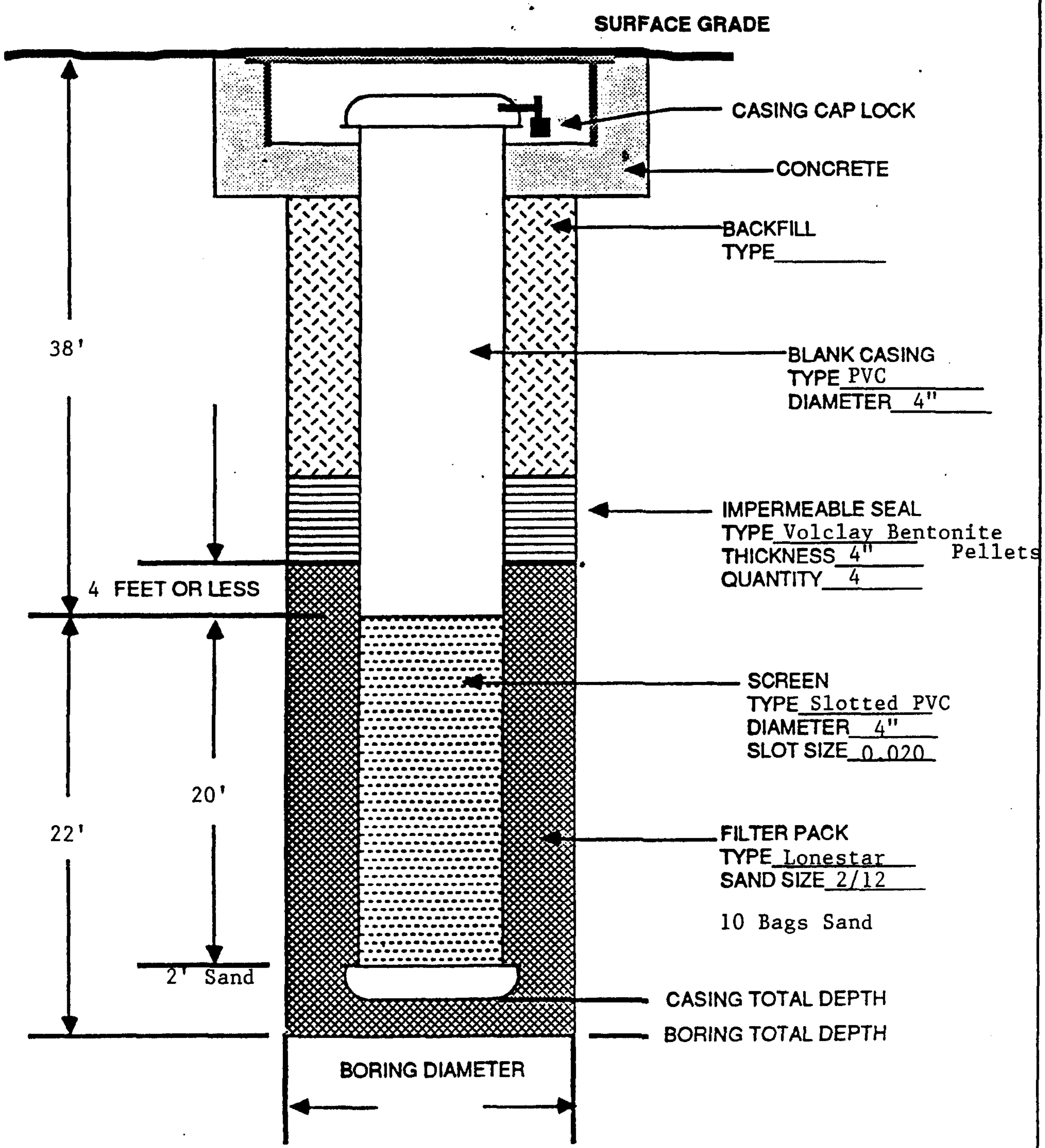
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-054/GW-09
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/13/88
SURFACE ELEV: 153.8
(FT ABOVE MSL)
TOP OF CASING: 153.5
(FT ABOVE MSL)
SURVEYED
WELL LOCATION: Mersit's Equipment
SITE MANAGER: R. Jenkins/D. Laney



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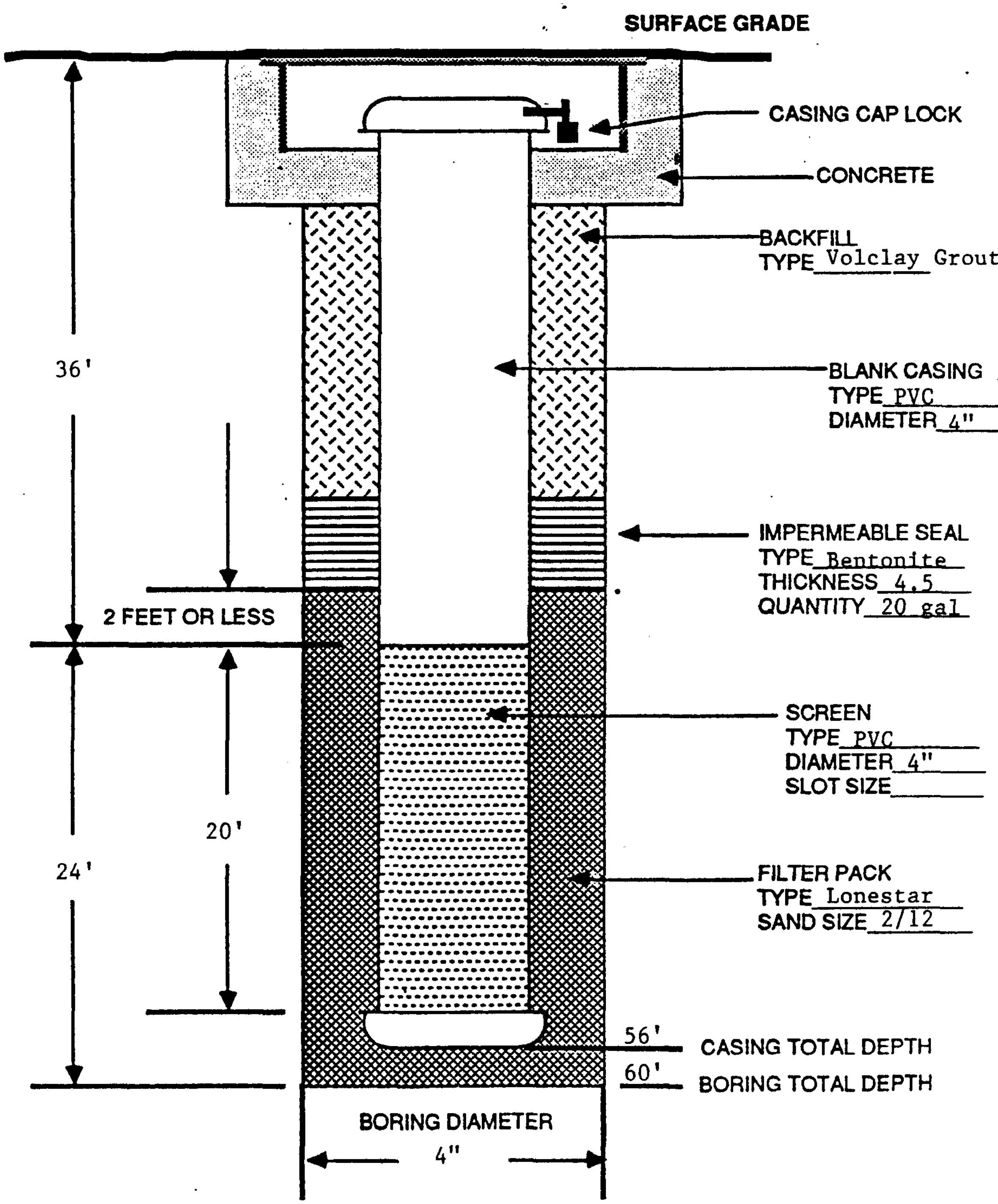
MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB--062/GW-21	INSTALLATION DATE:	10/1/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	155.5
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	155.2
TYPE OF WELL:	Groundwater MW	SURVEYED	
INSTALLATION Sub CONTRACTOR:	Datum	WELL LOCATION:	Atlas Heat Treating
		SITE MANAGER:	R. Jenkins



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MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB--072/GW-11

PROJECT NAME: Waste Disposal, Inc.

ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW (Shallow) cluster

INSTALLATION
Sub CONTRACTOR: Datum

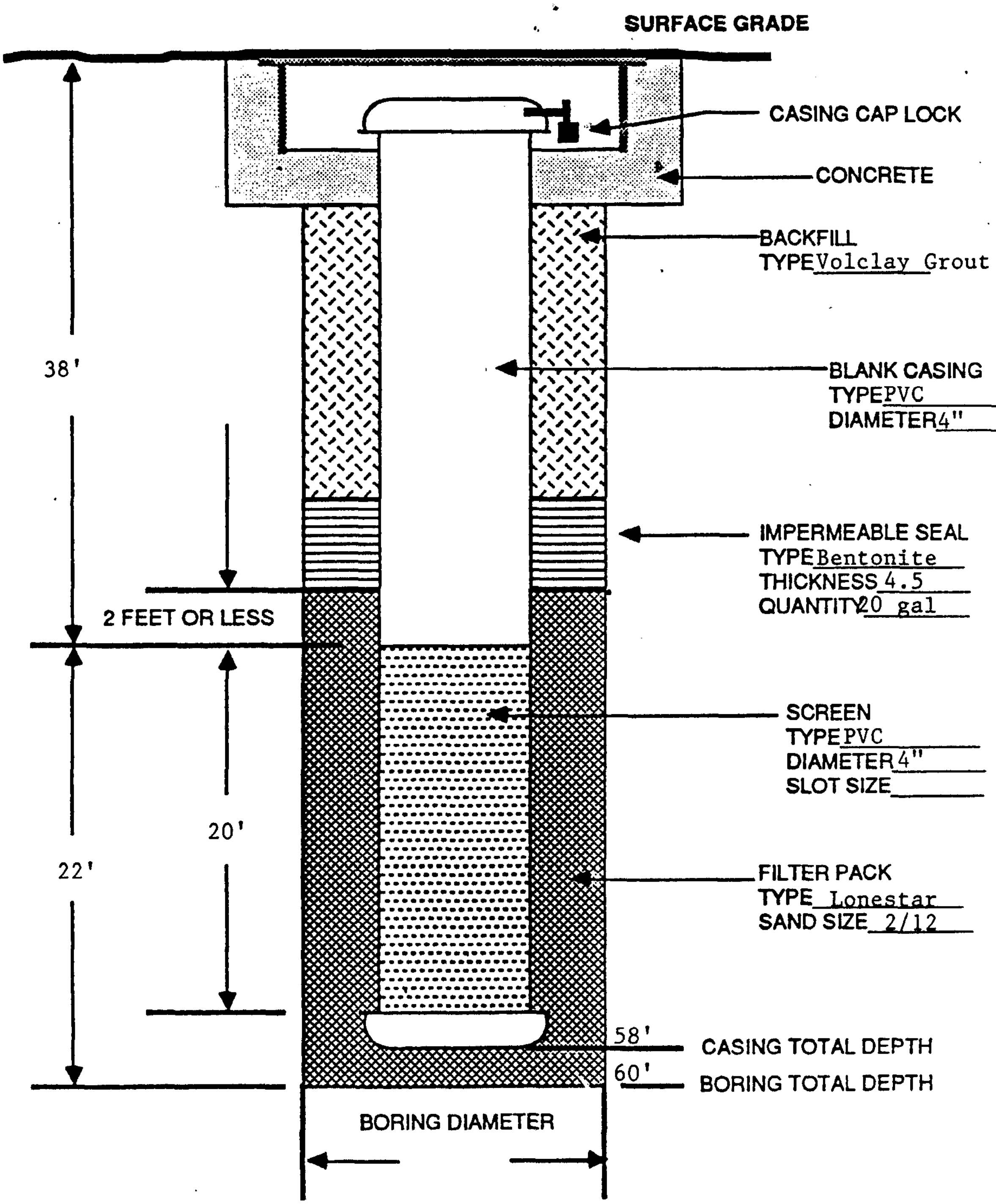
INSTALLATION DATE: 9/25/88

SURFACE ELEV: 154.9
(FT ABOVE MSL)

TOP OF CASING: 154.6
(FT ABOVE MSL)

SURVEYED
WELL LOCATION: Dialog

SITE MANAGER: R. Jenkins



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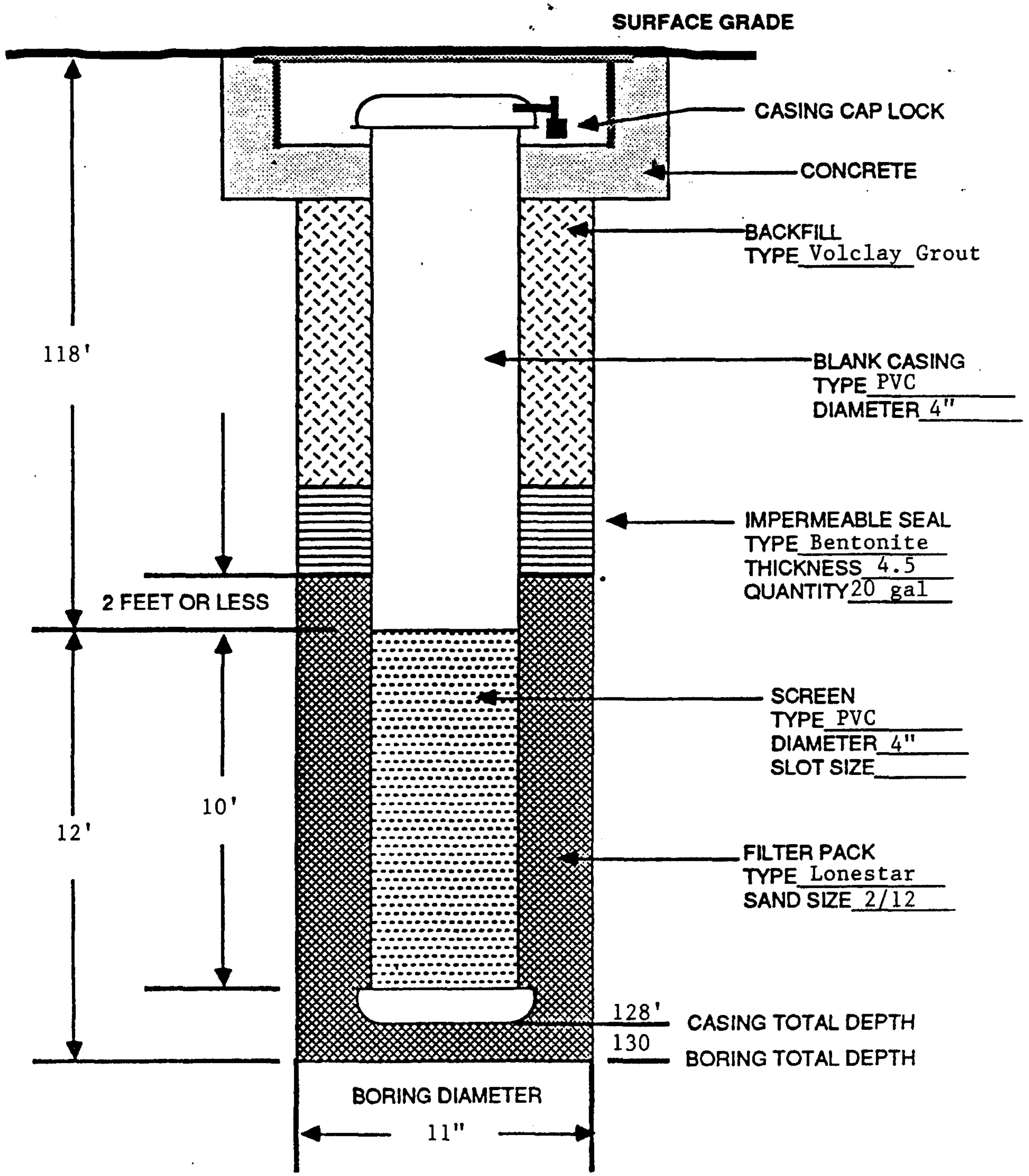
MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-073/GW-10
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION Sub CONTRACTOR: Datum

INSTALLATION DATE: 9/29/88
SURFACE ELEV: (FT ABOVE MSL) 155.0
TOP OF CASING: (FT ABOVE MSL) 154.7
SURVEYED WELL LOCATION: Dialog
SITE MANAGER: R. Jenkins



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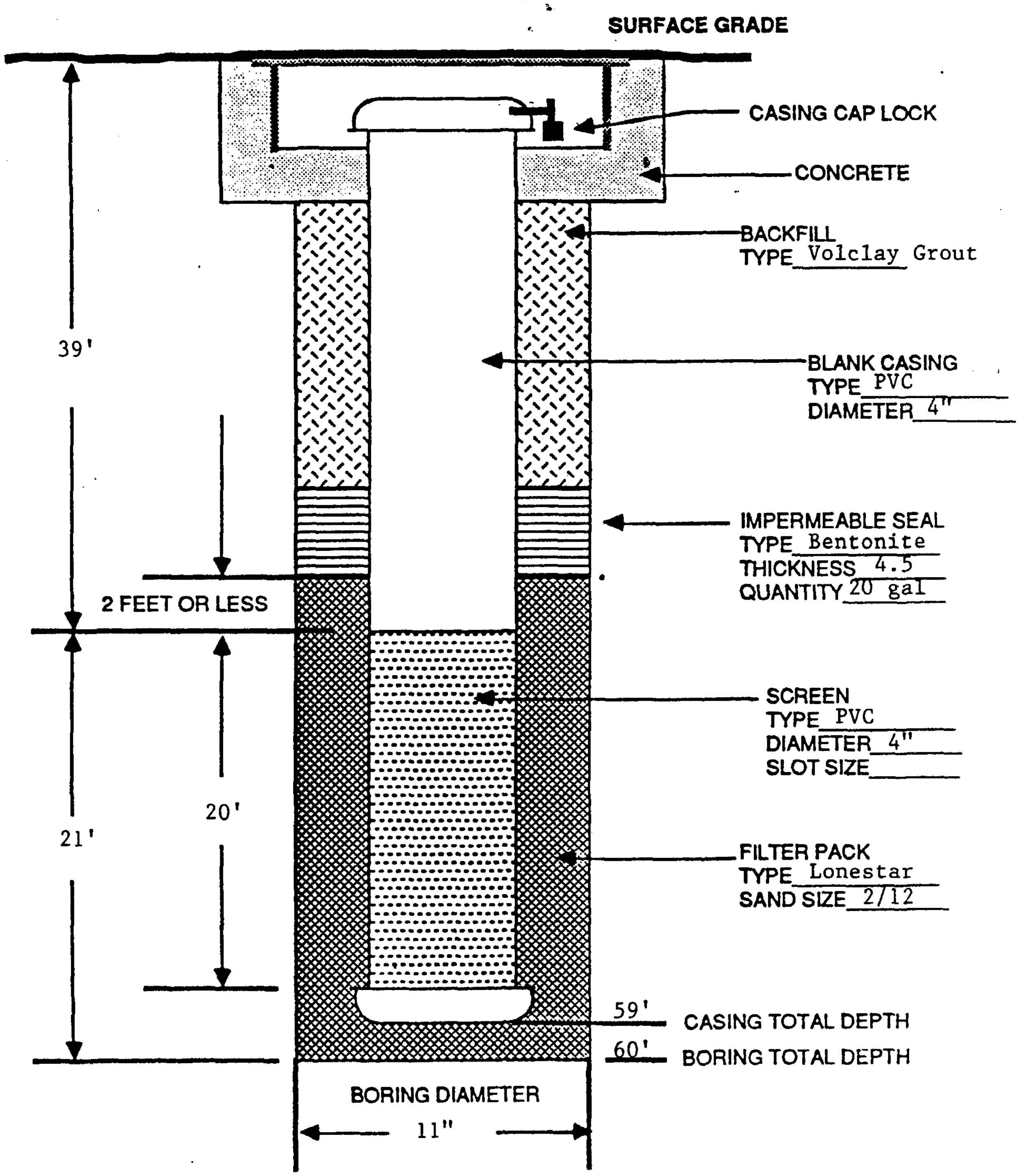
MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-075/GW-13
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GMW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/7/88
SURFACE ELEV: 157.8
(FT ABOVE MSL)
TOP OF CASING: 157.5
(FT ABOVE MSL)
SURVEYED
WELL LOCATION: Toxo (NE end)
SITE MANAGER: R. Jenkins



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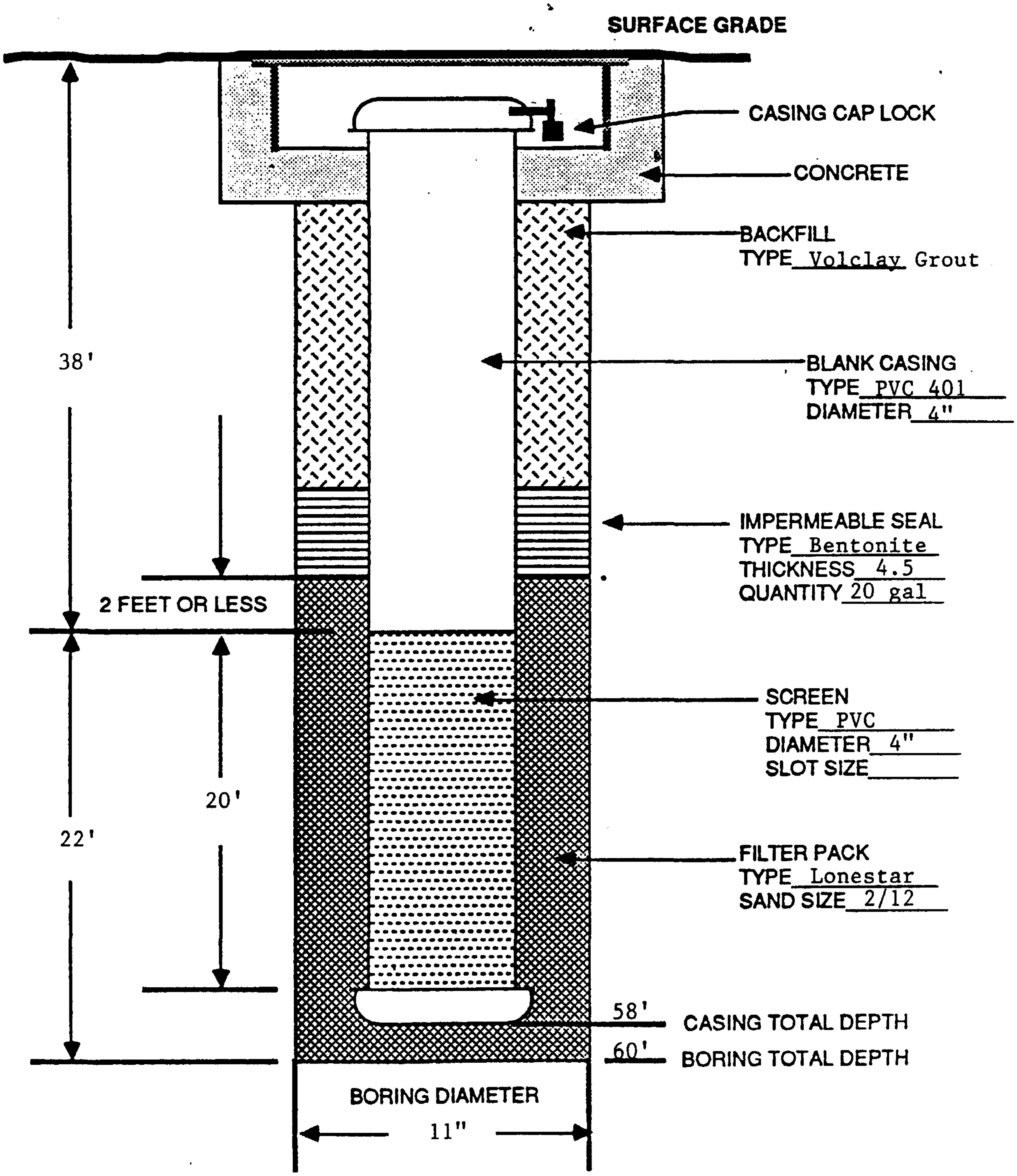
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-076/GW-14	INSTALLATION DATE:	10/18/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	157.9
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	157.6
TYPE OF WELL:	GMW	SURVEYED	
INSTALLATION		WELL LOCATION:	Terry Trucking
Sub CONTRACTOR:	Datum	SITE MANAGER:	R. Jenkins



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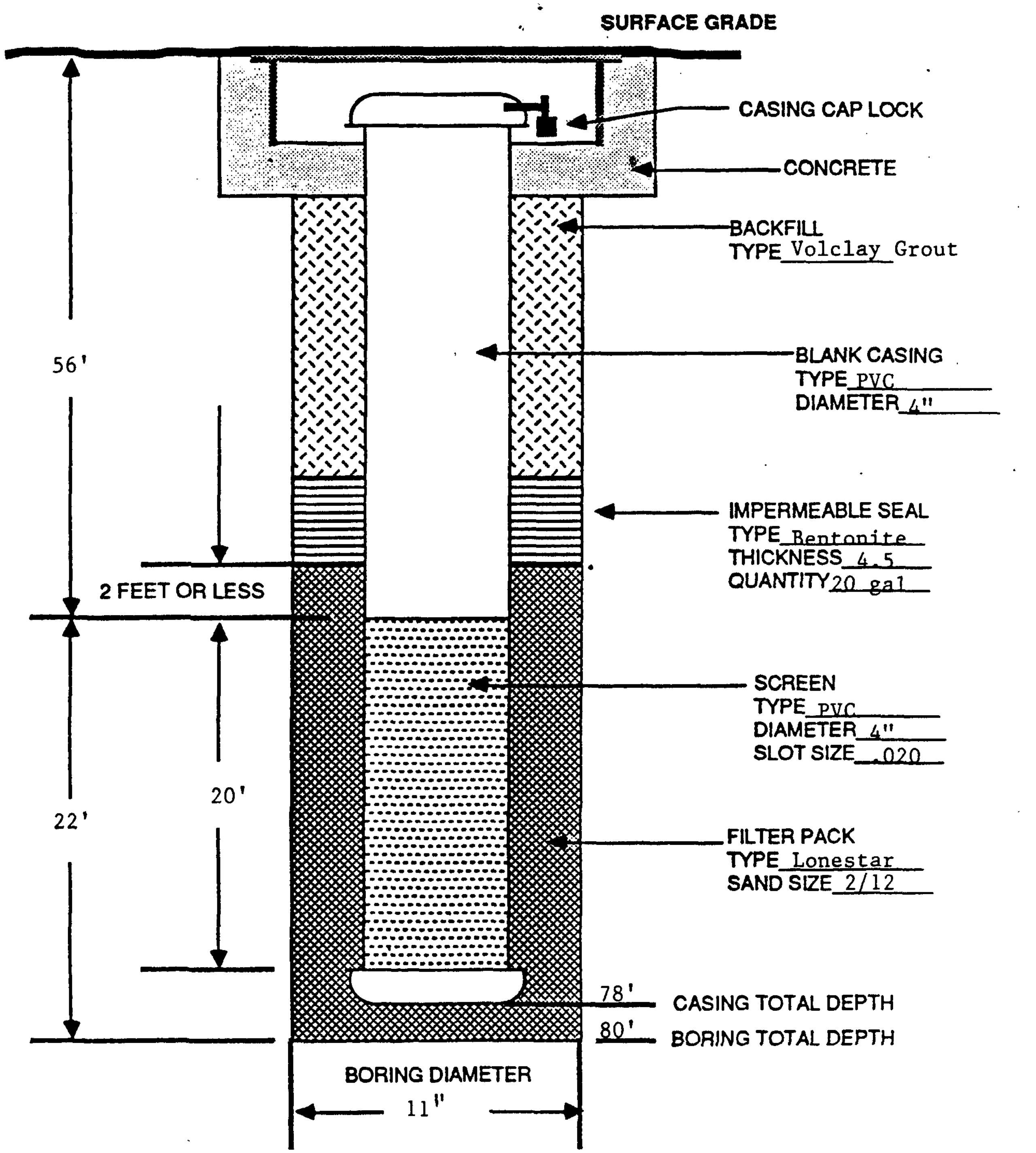
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-092-/Gw-22
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 9/23/88
SURFACE ELEV: 156.9
(FT ABOVE MSL)
TOP OF CASING: 156.6
(FT ABOVE MSL)
SURVEYED
WELL LOCATION: Dialog (West Corner)
SITE MANAGER: R. Jenkins



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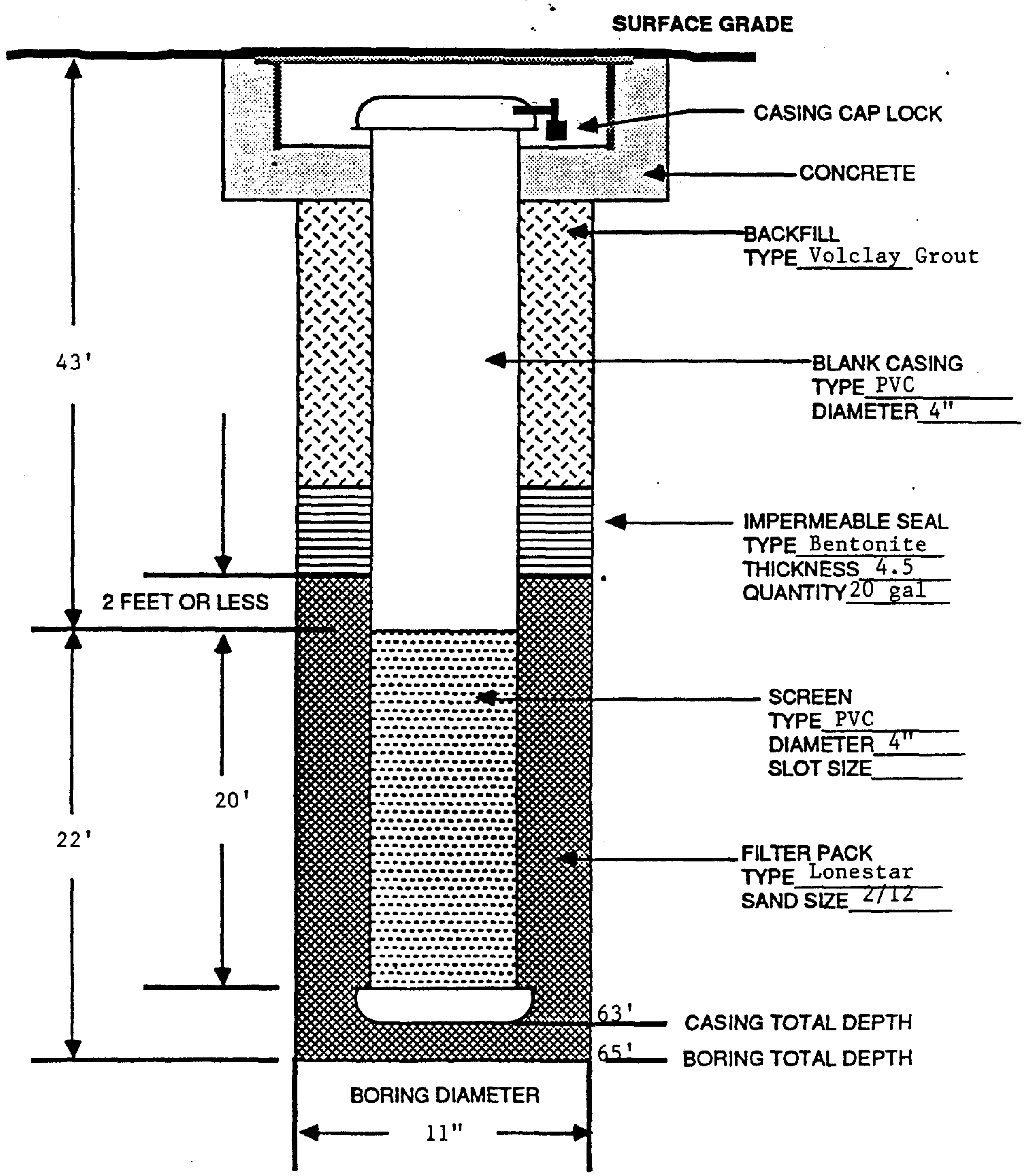
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-093/GW-23
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/4/88
SURFACE ELEV: (FT ABOVE MSL) 157.2
TOP OF CASING: (FT ABOVE MSL) 157.0
SURVEYED
WELL LOCATION: Toxo Spray Dust
SITE MANAGER: R. Jenkins



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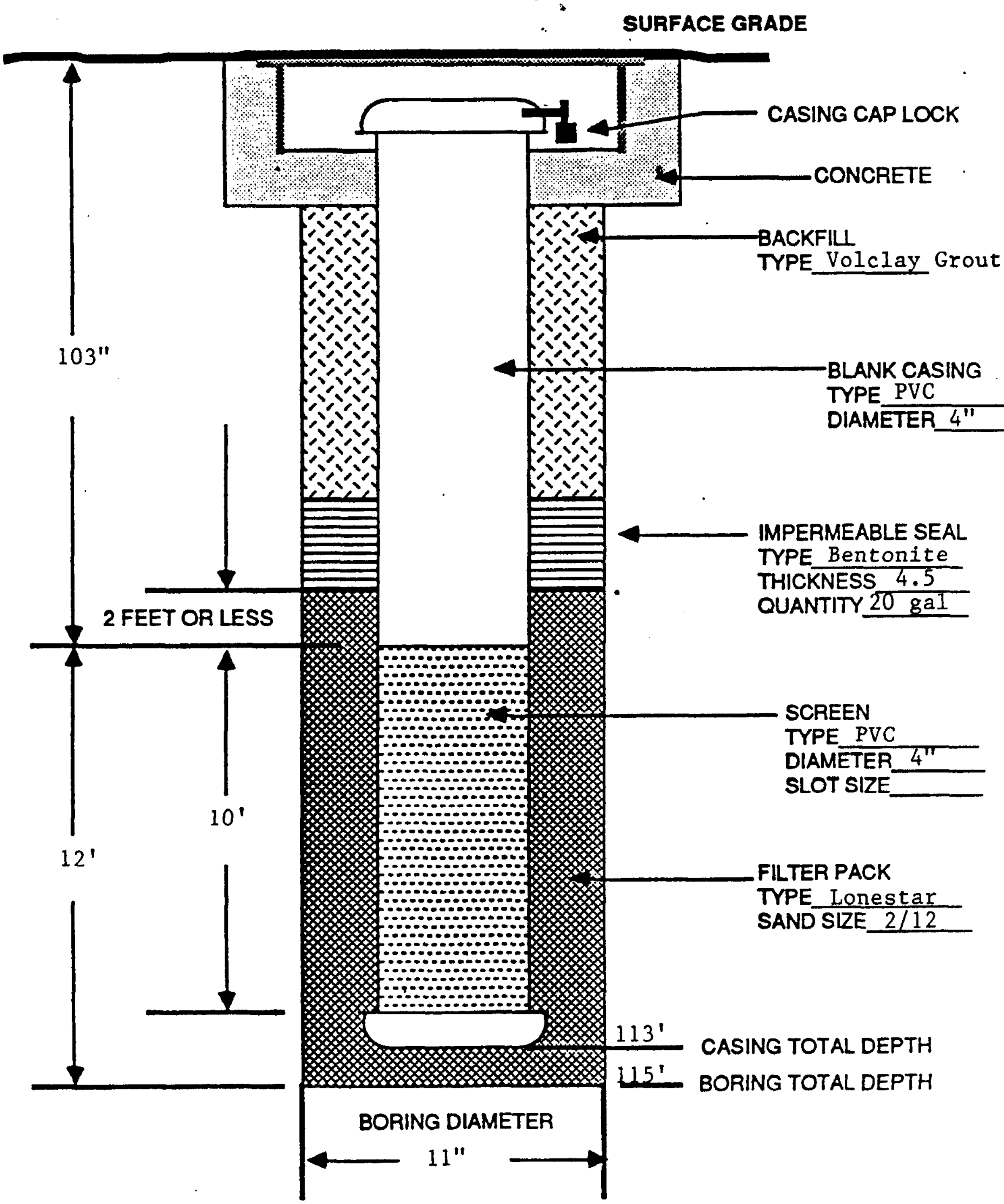
EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-094/GW-24
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GMW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/5/88
SURFACE ELEV: (FT ABOVE MSL) 157.0
TOP OF CASING: (FT ABOVE MSL) 156.7
SURVEYED
WELL LOCATION: Toxo Spray Dust
SITE MANAGER: R. Jenkins



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MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-096/GW-26

PROJECT NAME: Waste Disposal, Inc.

ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW

INSTALLATION Sub CONTRACTOR: Datum

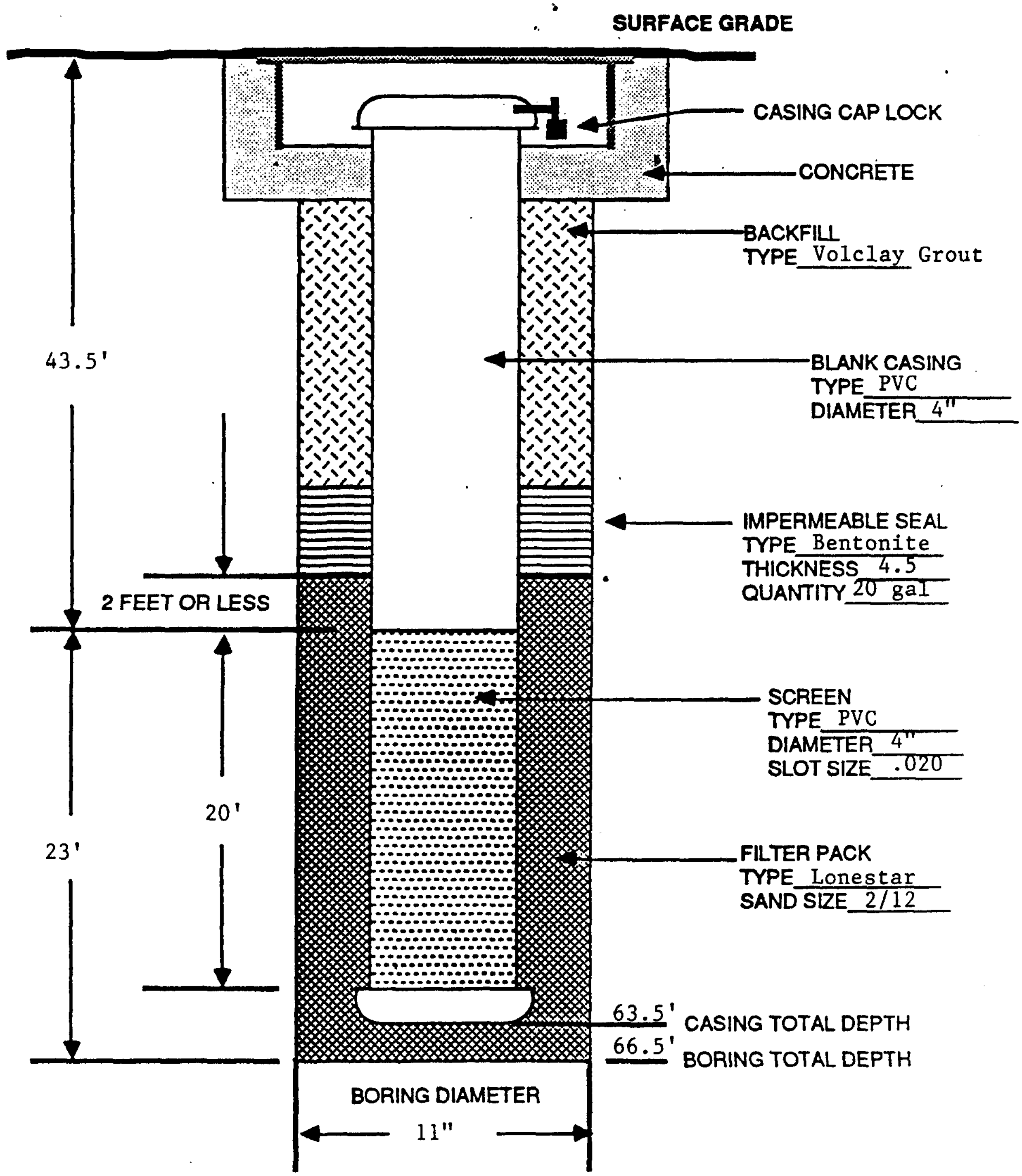
INSTALLATION DATE: 9/20/88

SURFACE ELEV: (FT ABOVE MSL) 156.3

TOP OF CASING: (FT ABOVE MSL) 156.0

SURVEYED WELL LOCATION: Timmons Wood

SITE MANAGER: R. Jenkins



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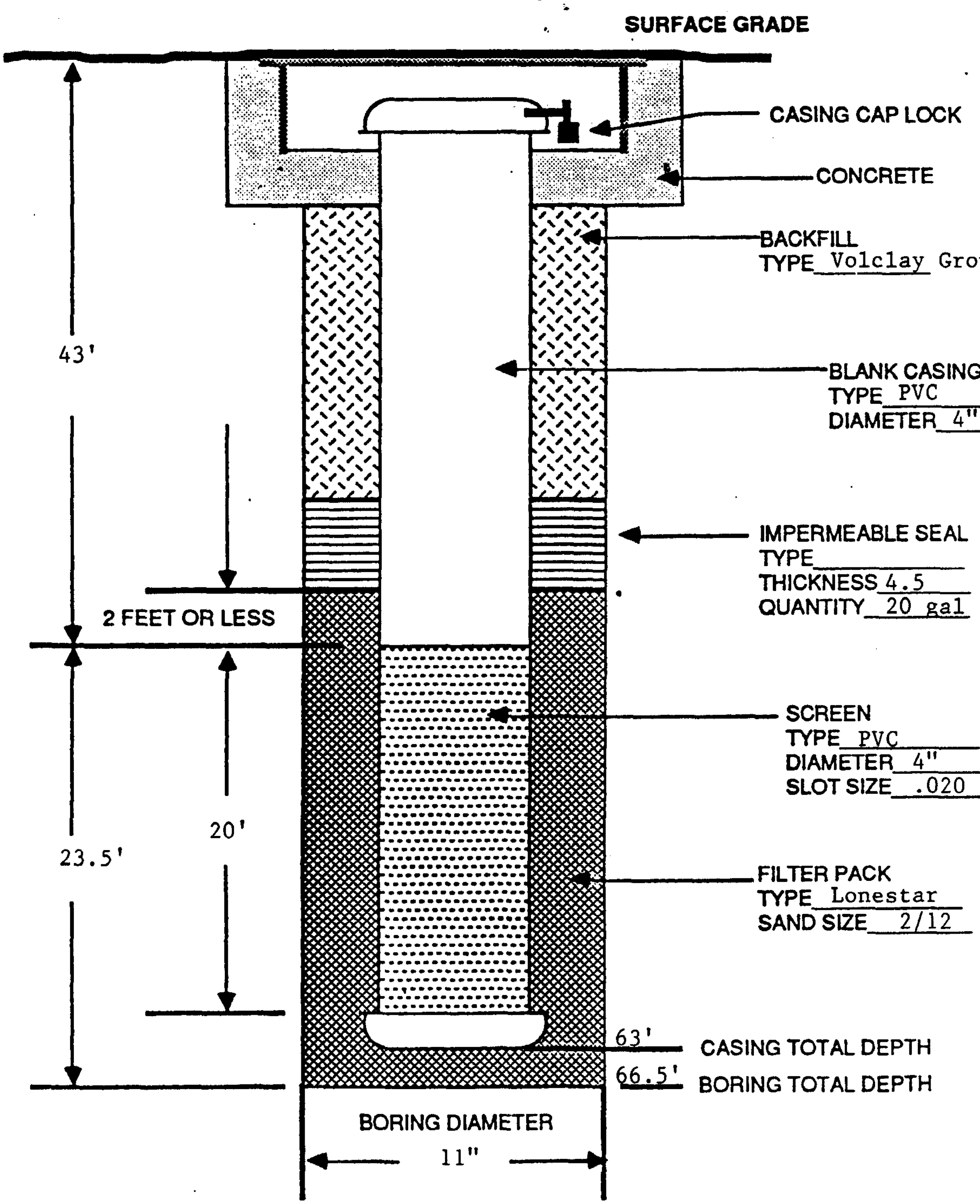
MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-097/GW-27
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GW
INSTALLATION Sub CONTRACTOR: Datum

INSTALLATION DATE: 9/22/88
SURFACE ELEV: 157.3 (FT ABOVE MSL)
TOP OF CASING: 157.0 (FT ABOVE MSL)

SURVEYED WELL LOCATION: Rick's Smog Service
SITE MANAGER: R. Jenkins



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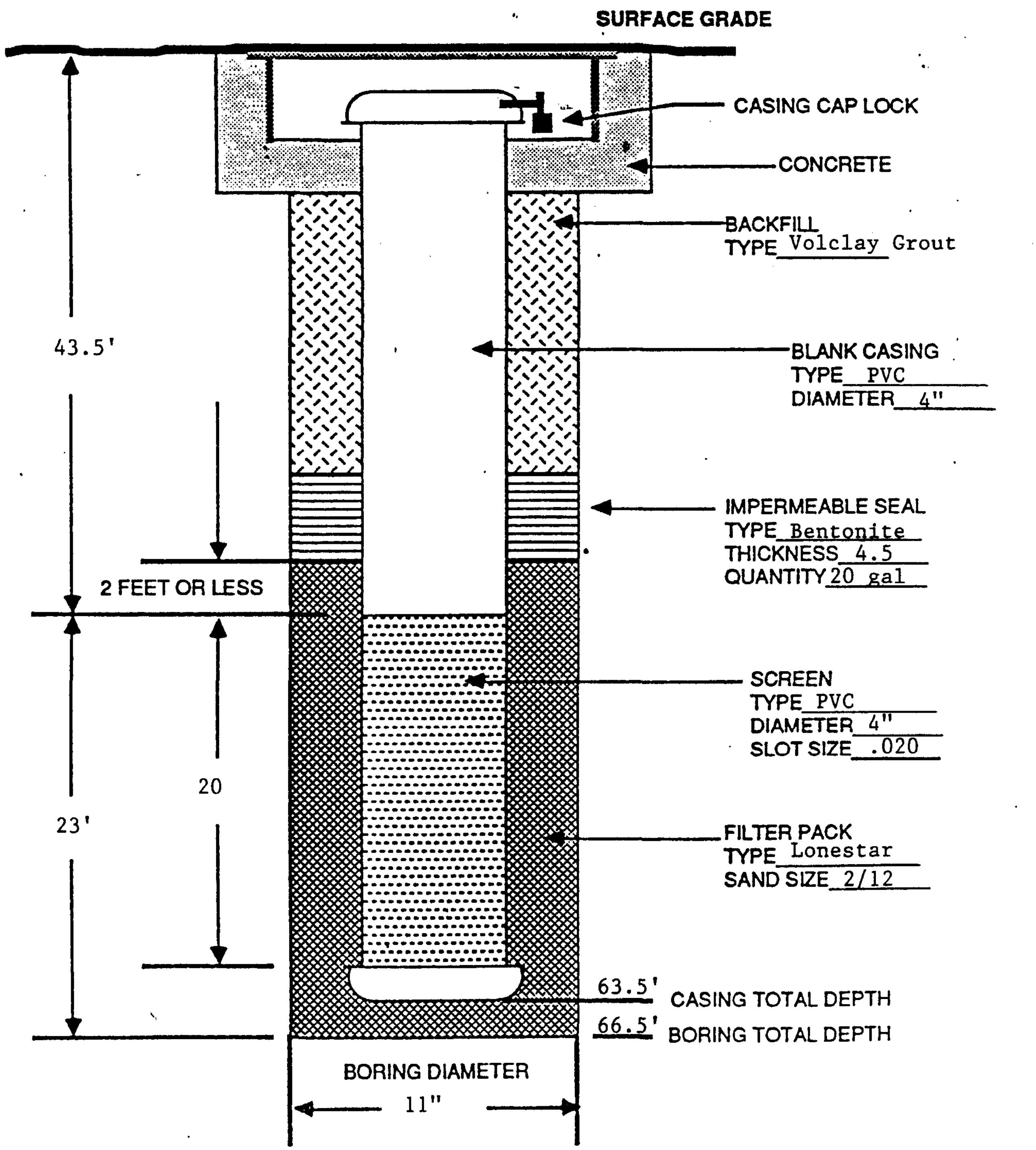
MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-098/GW-28	INSTALLATION DATE:	9/19/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	157.6
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	156.3
TYPE OF WELL:	GW	SURVEYED	
INSTALLATION		WELL LOCATION:	Campbell
Sub CONTRACTOR:	Datum	SITE MANAGER:	R. Jenkins



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EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB--099/GW-29

PROJECT NAME: Waste Disposal, Inc.

ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GMW

INSTALLATION Sub CONTRACTOR: Datum

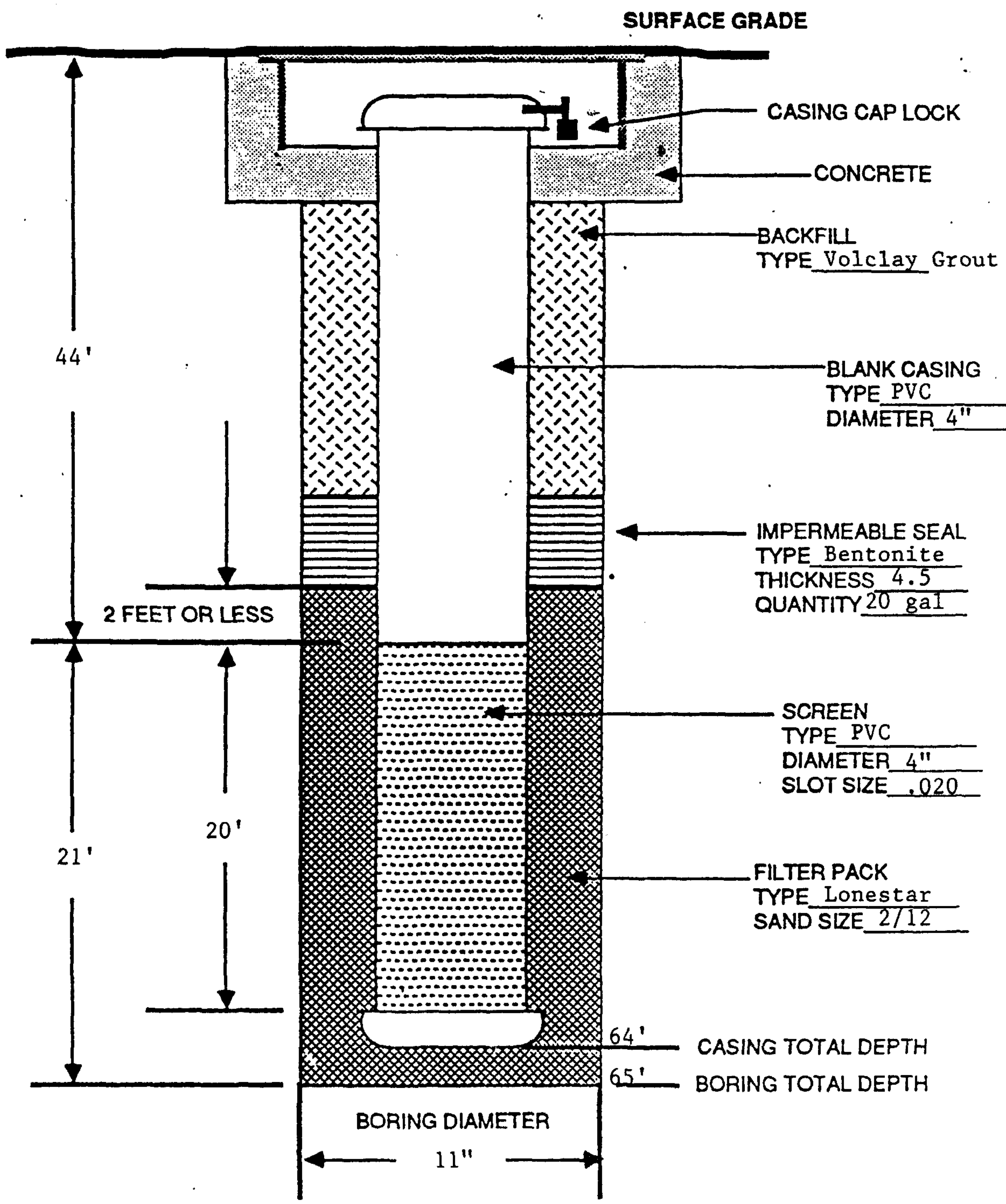
INSTALLATION DATE: 10/6/88

SURFACE ELEV: (FT ABOVE MSL) 157.7

TOP OF CASING: (FT ABOVE MSL) 157.4

SURVEYED WELL LOCATION: Campbell

SITE MANAGER: R. Jenkins



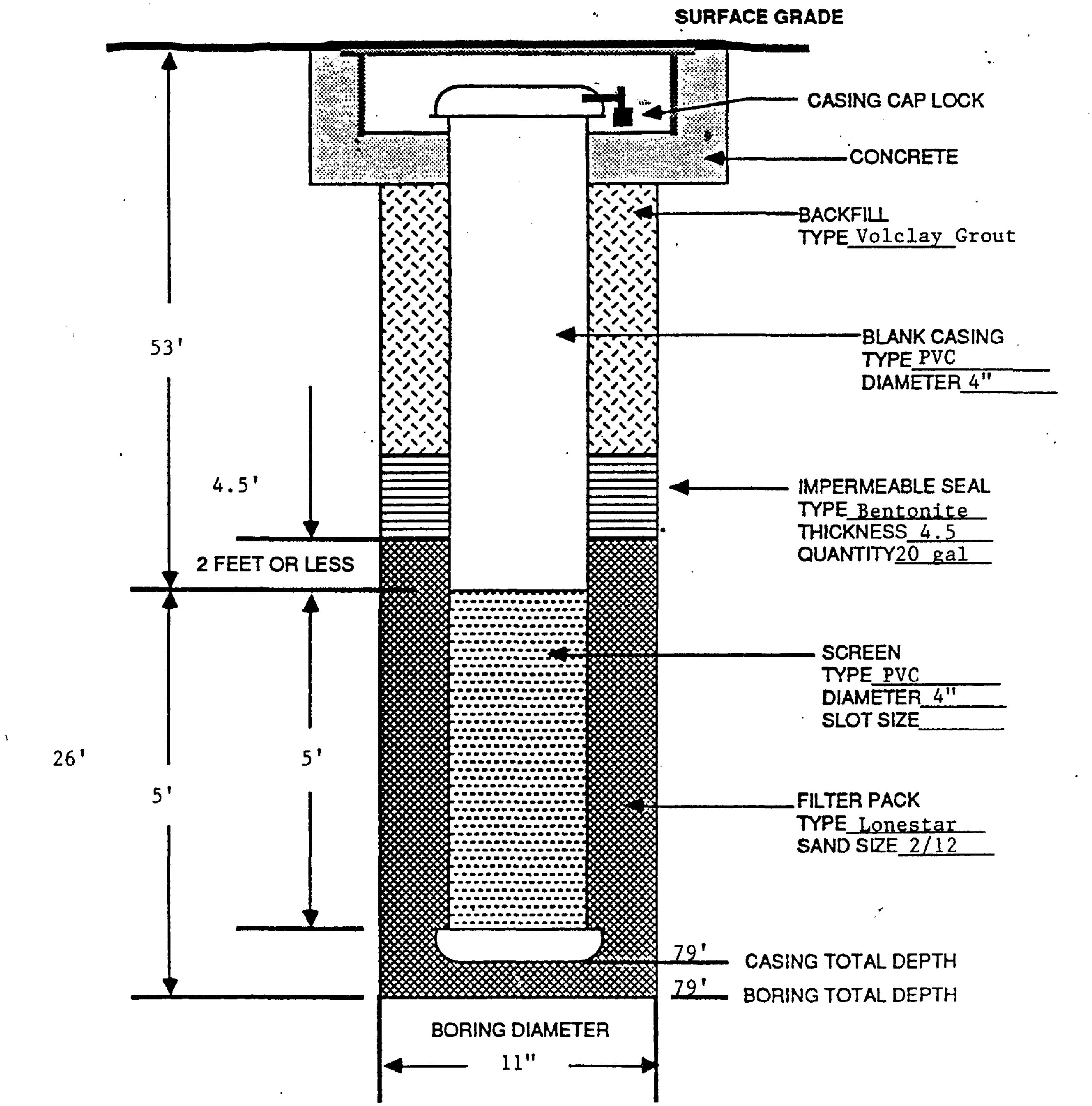
EBASCO SERVICES INCORPORATED EBASCO
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-101/GW-16
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GMW
INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/17/88
SURFACE ELEV: 163.3
(FT ABOVE MSL)
TOP OF CASING: 163.0
(FT ABOVE MSL)
SURVEYED
WELL LOCATION: Reservoir Area
SITE MANAGER: R. Jenkins



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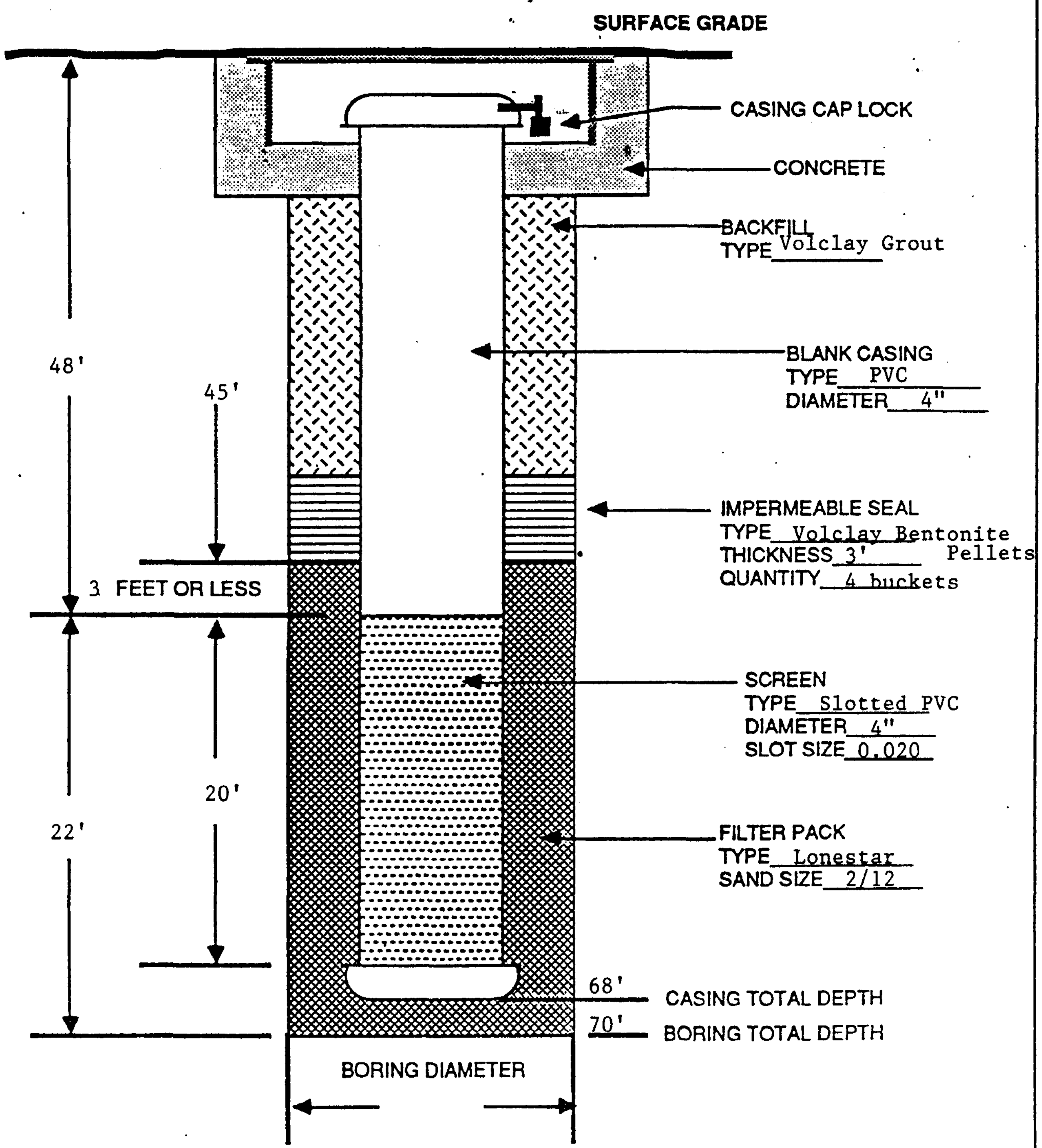
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-103/GW-15	INSTALLATION DATE:	10/12/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	163.6
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	163.3
TYPE OF WELL:	G. W. Well	SURVEYED WELL LOCATION:	Reservoir Area
INSTALLATION Sub CONTRACTOR:	Datum	SITE MANAGER:	R. Jenkins



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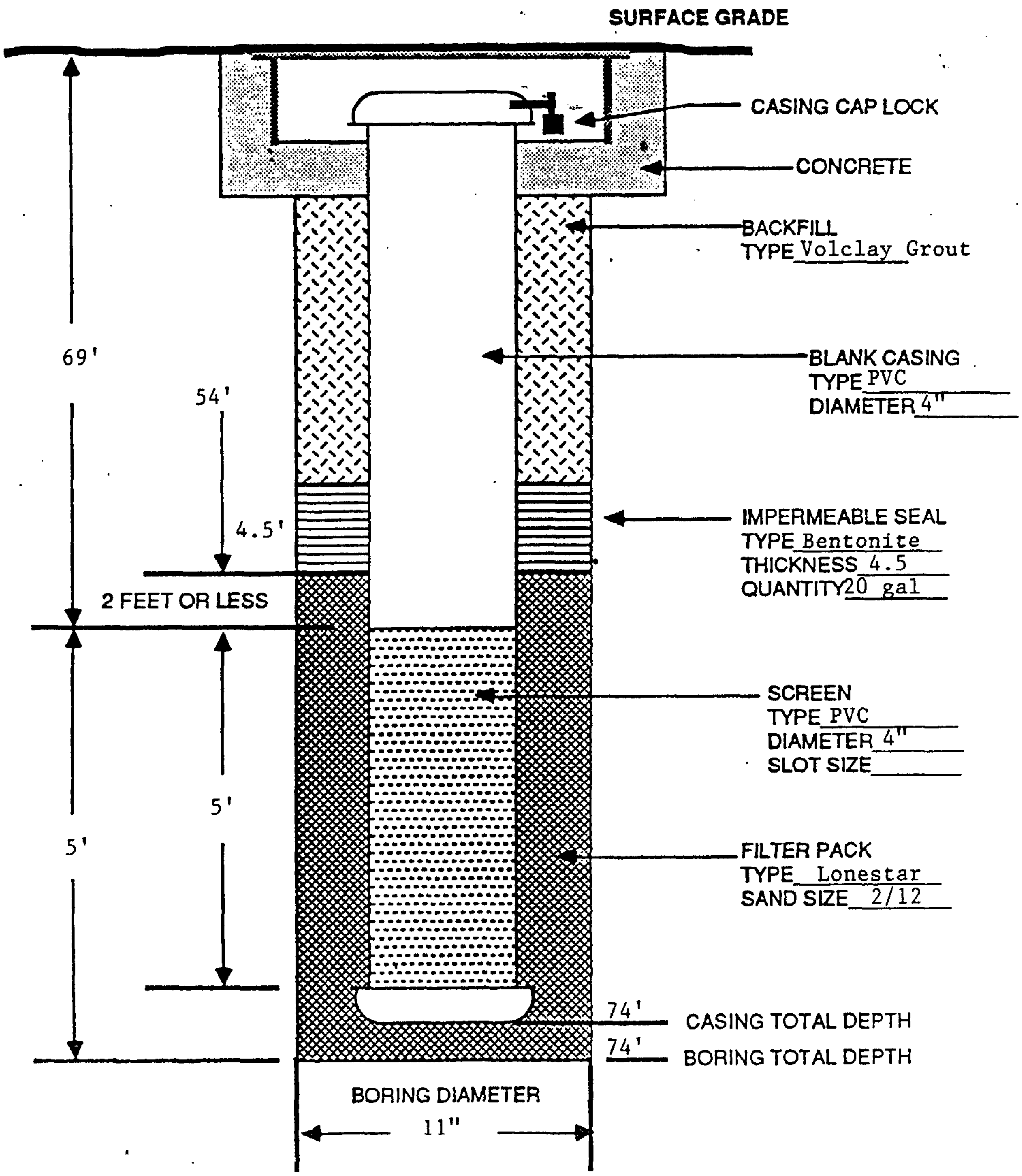
MONITORING WELL INSTALLATION REPORT

WELL NUMBER:	SB-104/GW-18	INSTALLATION DATE:	10/14/88
PROJECT NAME:	Waste Disposal, Inc.	SURFACE ELEV: (FT ABOVE MSL)	159.3
ADDRESS:	9648 Santa Fe Springs Road Santa Fe Springs, CA	TOP OF CASING: (FT ABOVE MSL)	159.0
TYPE OF WELL:	GMW (intermediate well)	SURVEYED WELL LOCATION:	H & H Contractors
INSTALLATION Sub CONTRACTOR:	Datum	SITE MANAGER:	R. Jenkins



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EBASCO

MONITORING WELL INSTALLATION REPORT

WELL NUMBER: SB-105/GW-19
PROJECT NAME: Waste Disposal, Inc.
ADDRESS: 9648 Santa Fe Springs Road
Santa Fe Springs, CA

TYPE OF WELL: GMW (shallow well)

INSTALLATION
Sub CONTRACTOR: Datum

INSTALLATION DATE: 10/14/88
SURFACE ELEV: 159.2
(FT ABOVE MSL)

TOP OF CASING: 159.0
(FT ABOVE MSL)

SURVEYED
WELL LOCATION: H & H Contractors
SITE MANAGER: R. Jenkins